SEPTEMBER 14, 1961

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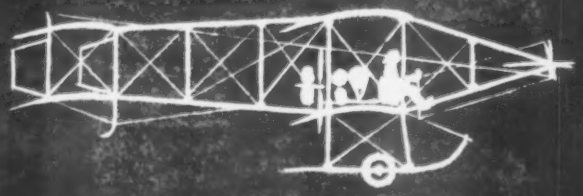
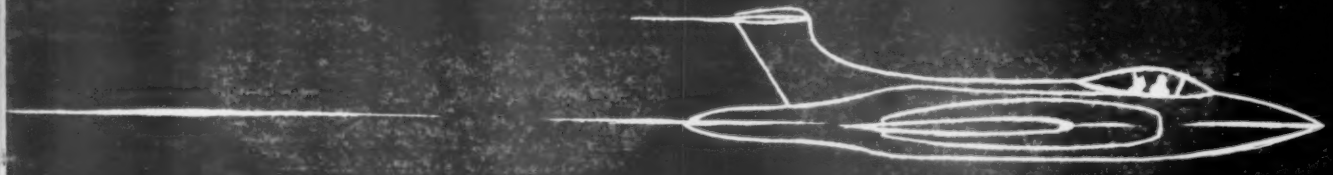


YEARS OF PROGRESS



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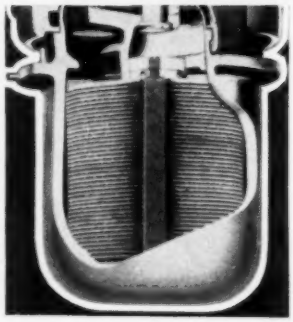

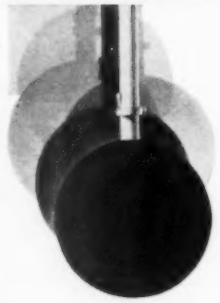

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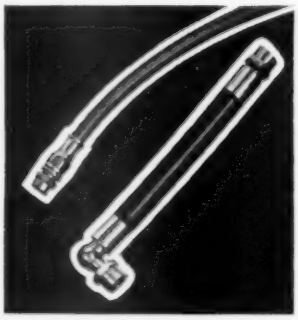

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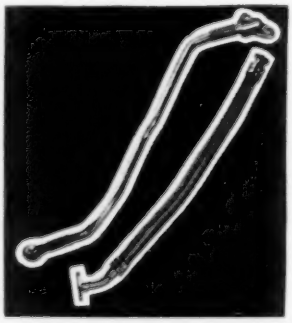

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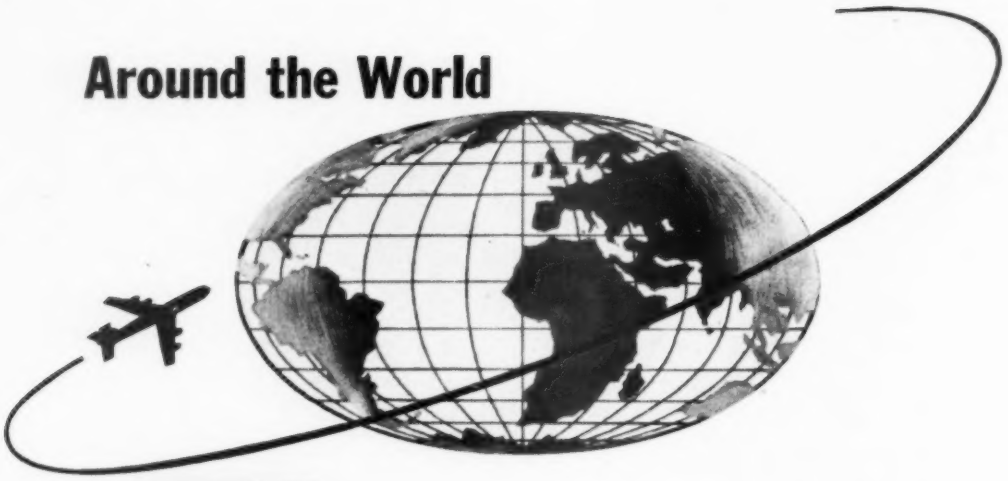

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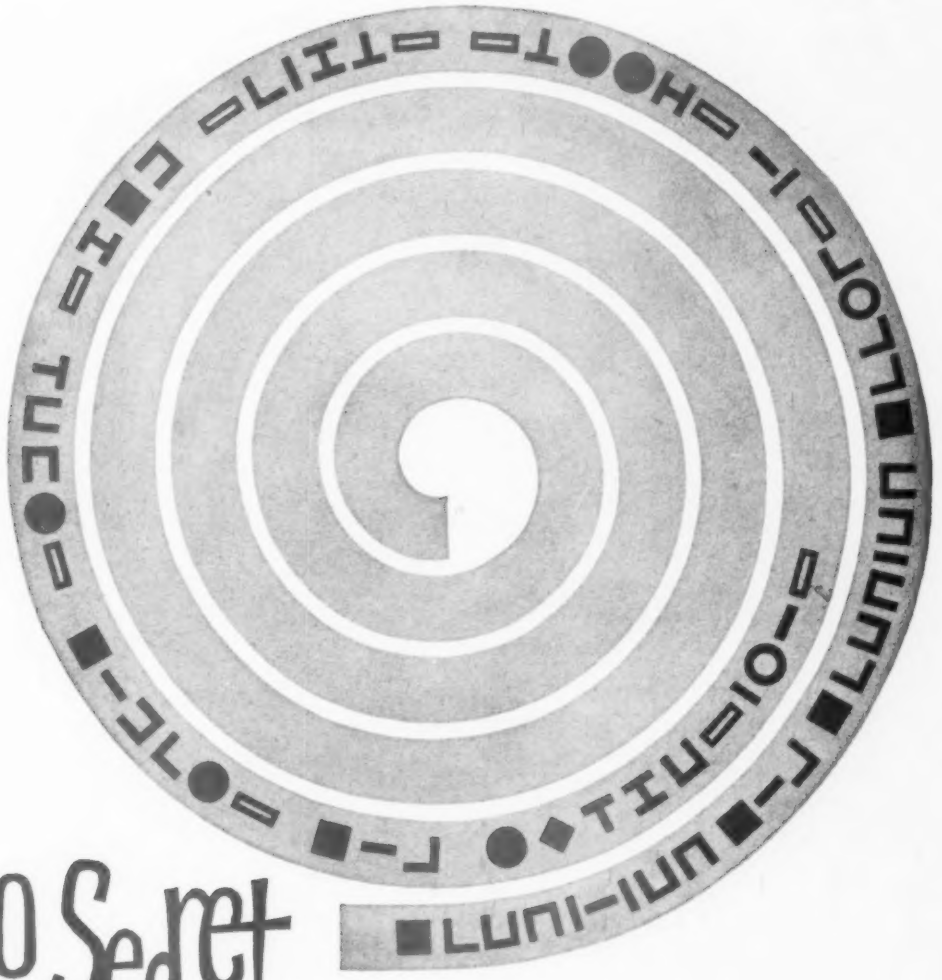

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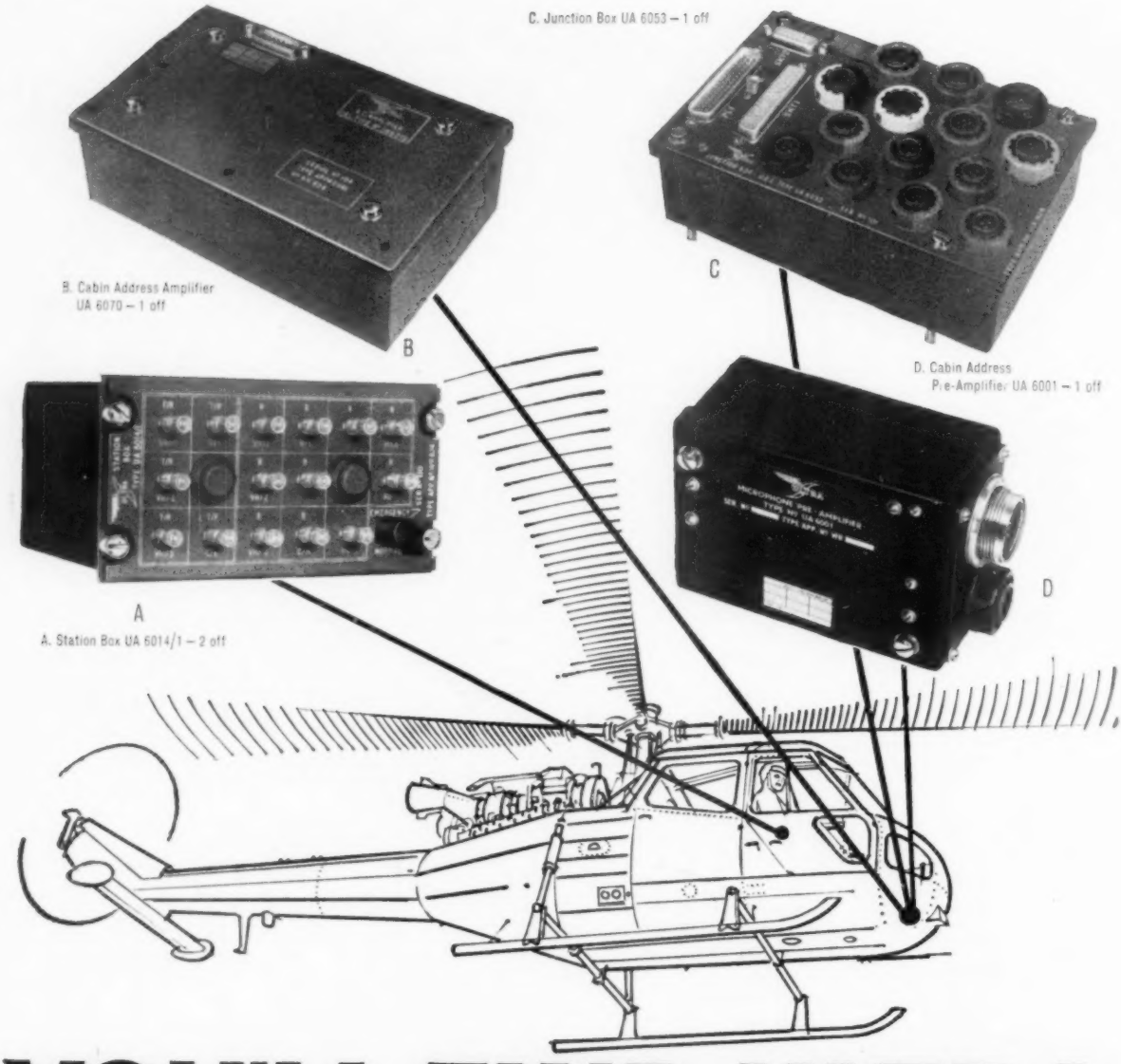
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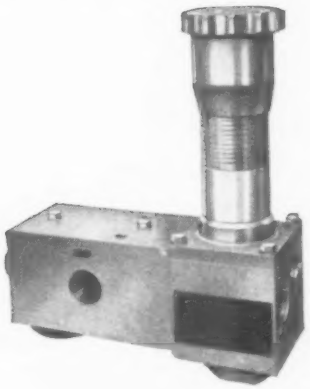

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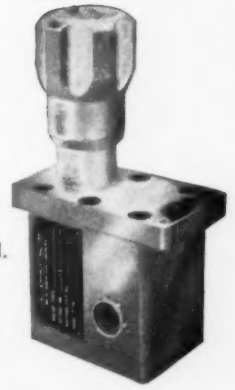

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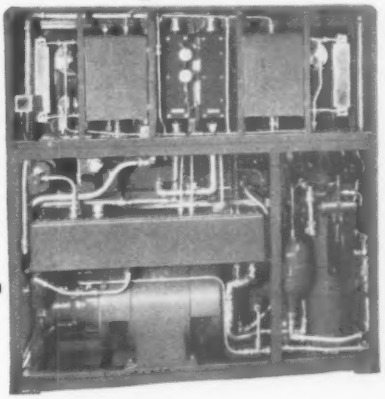

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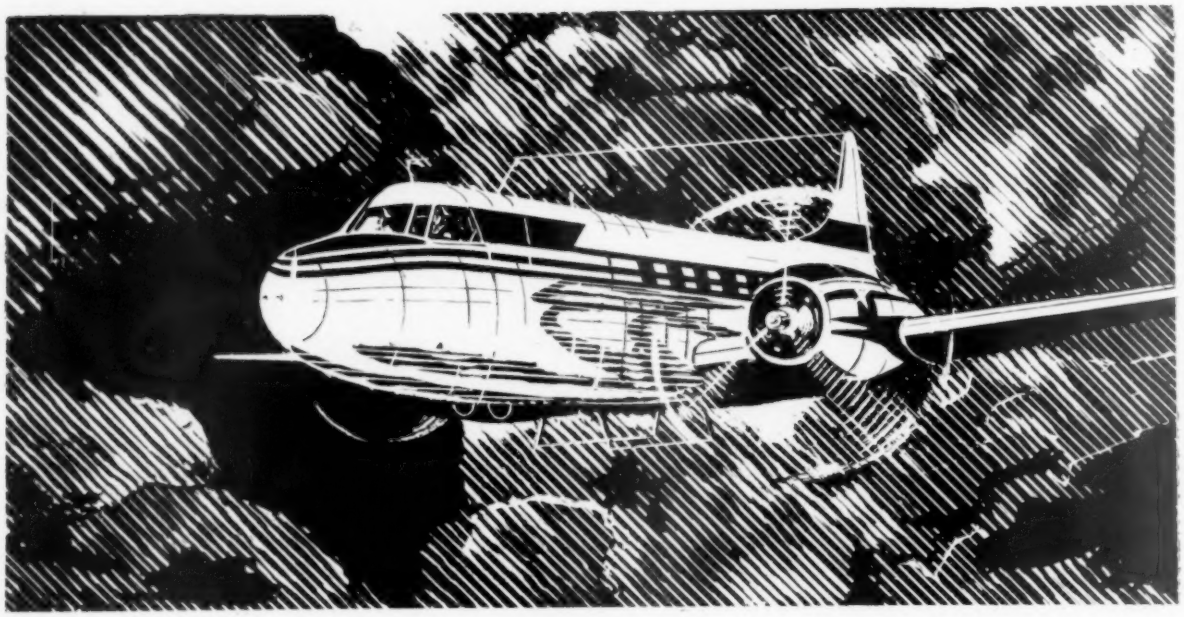

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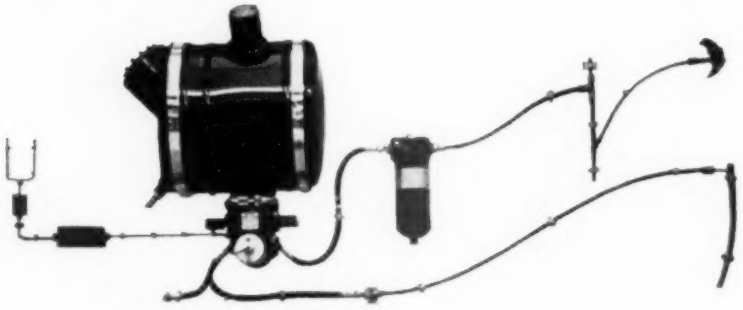

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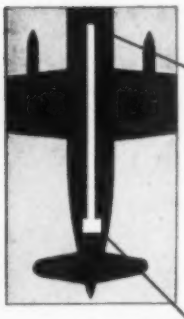
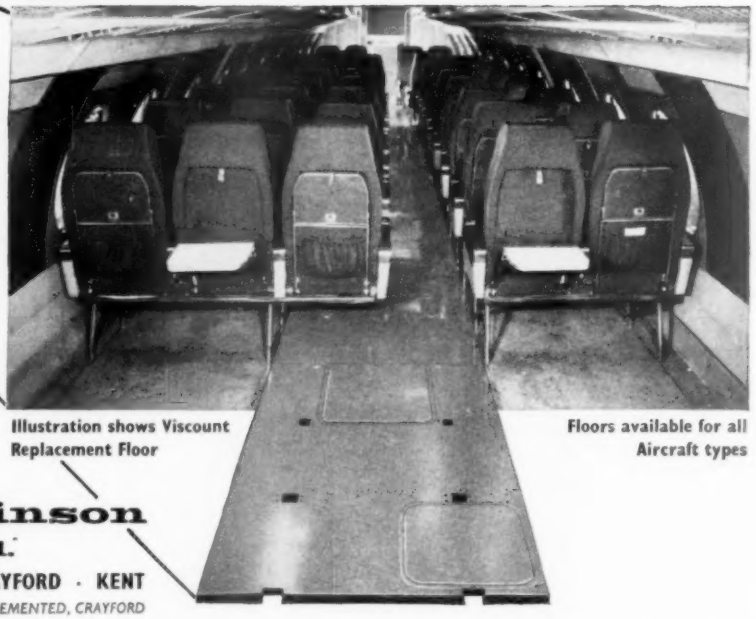


If you have the AIRCRAFT we have the FLOOR . . .



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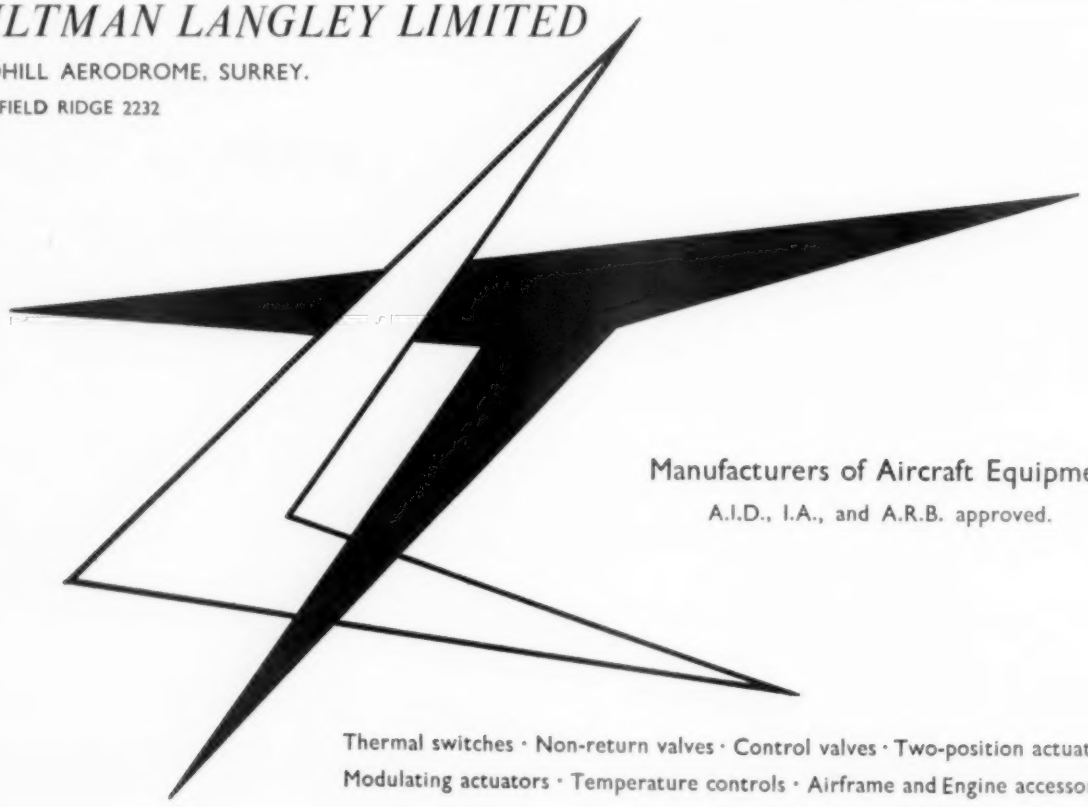

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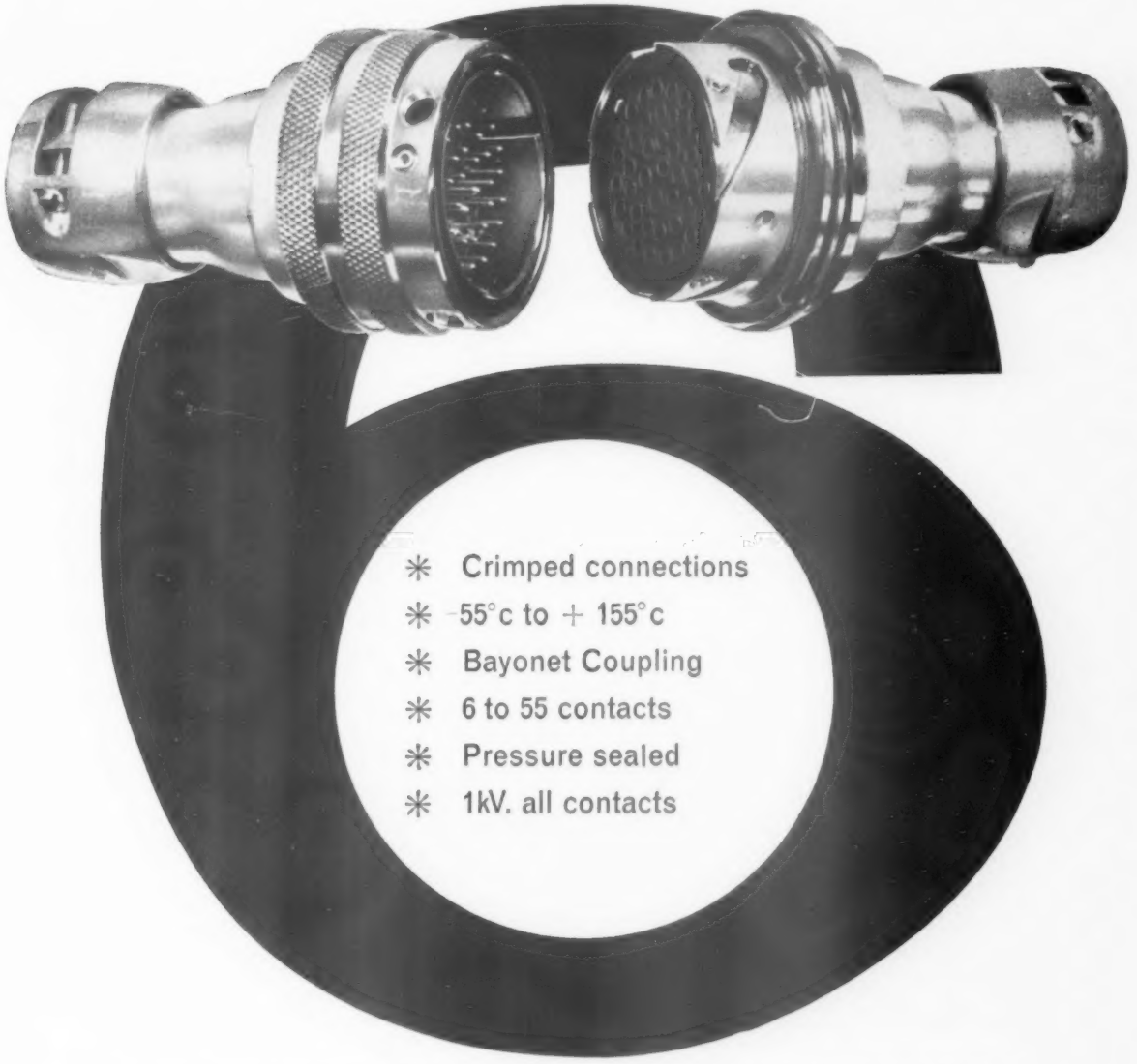

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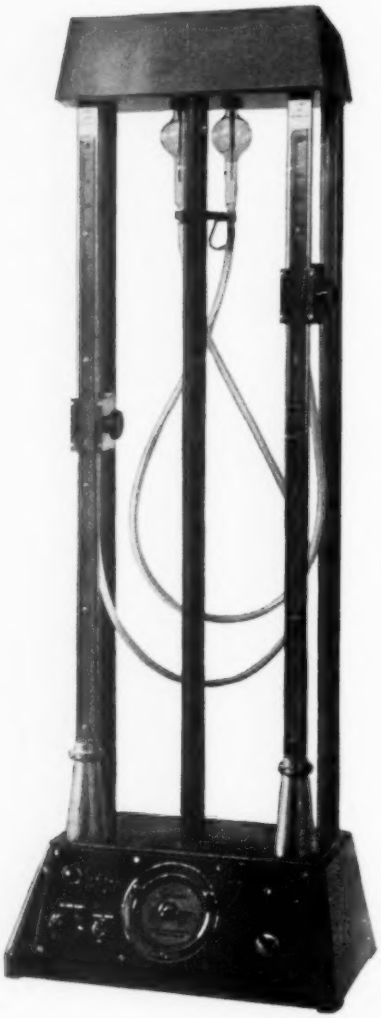

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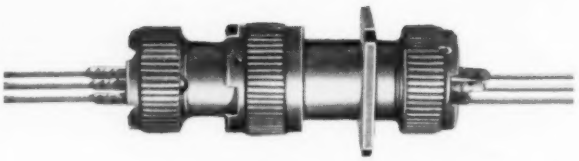

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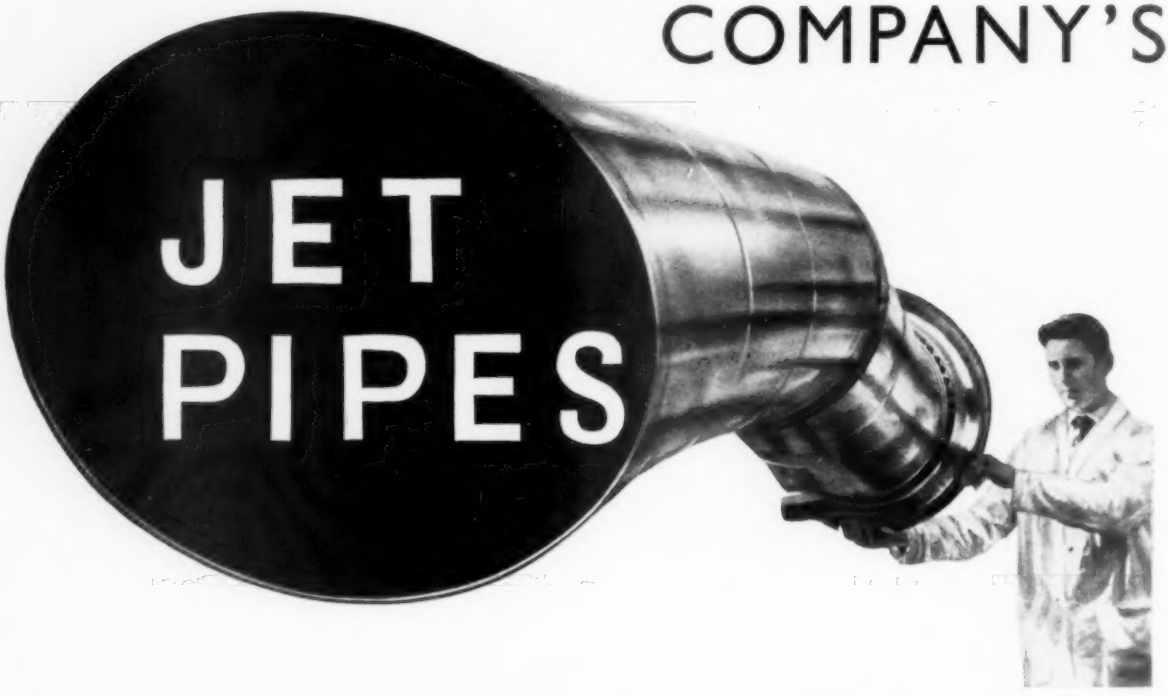

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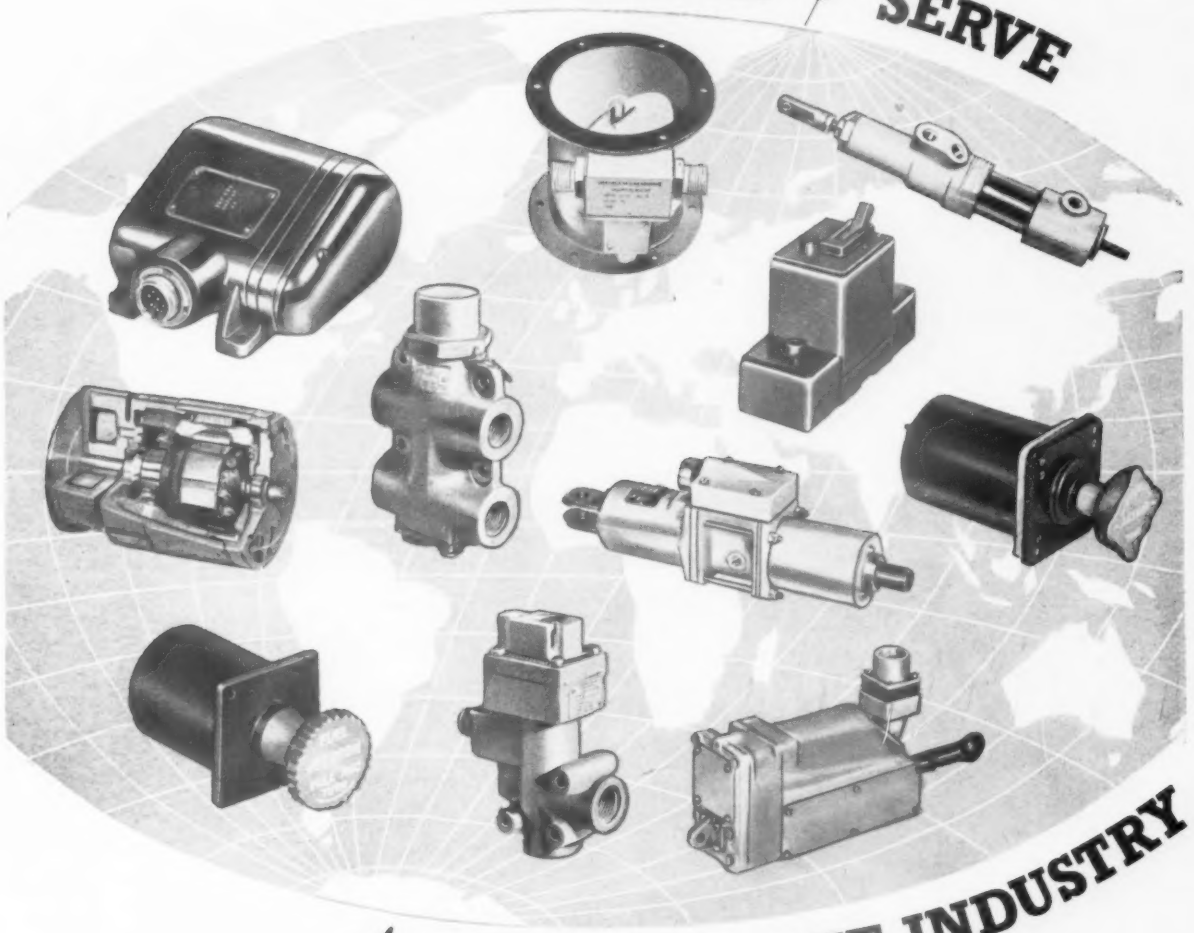

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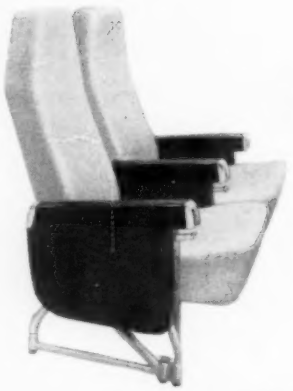

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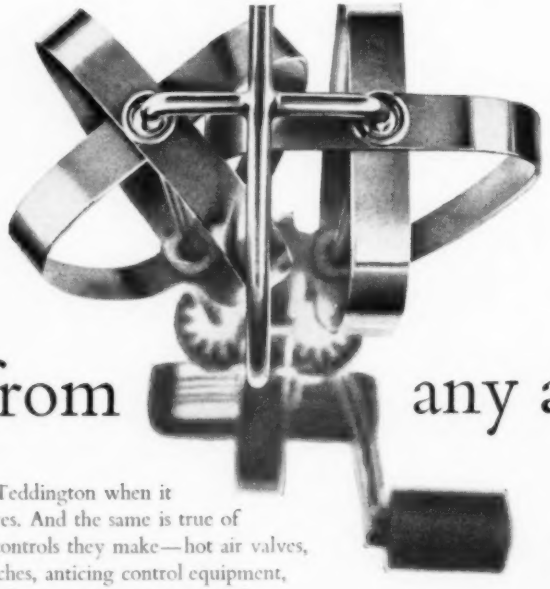

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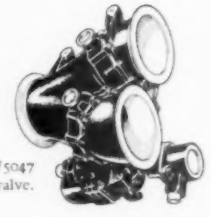

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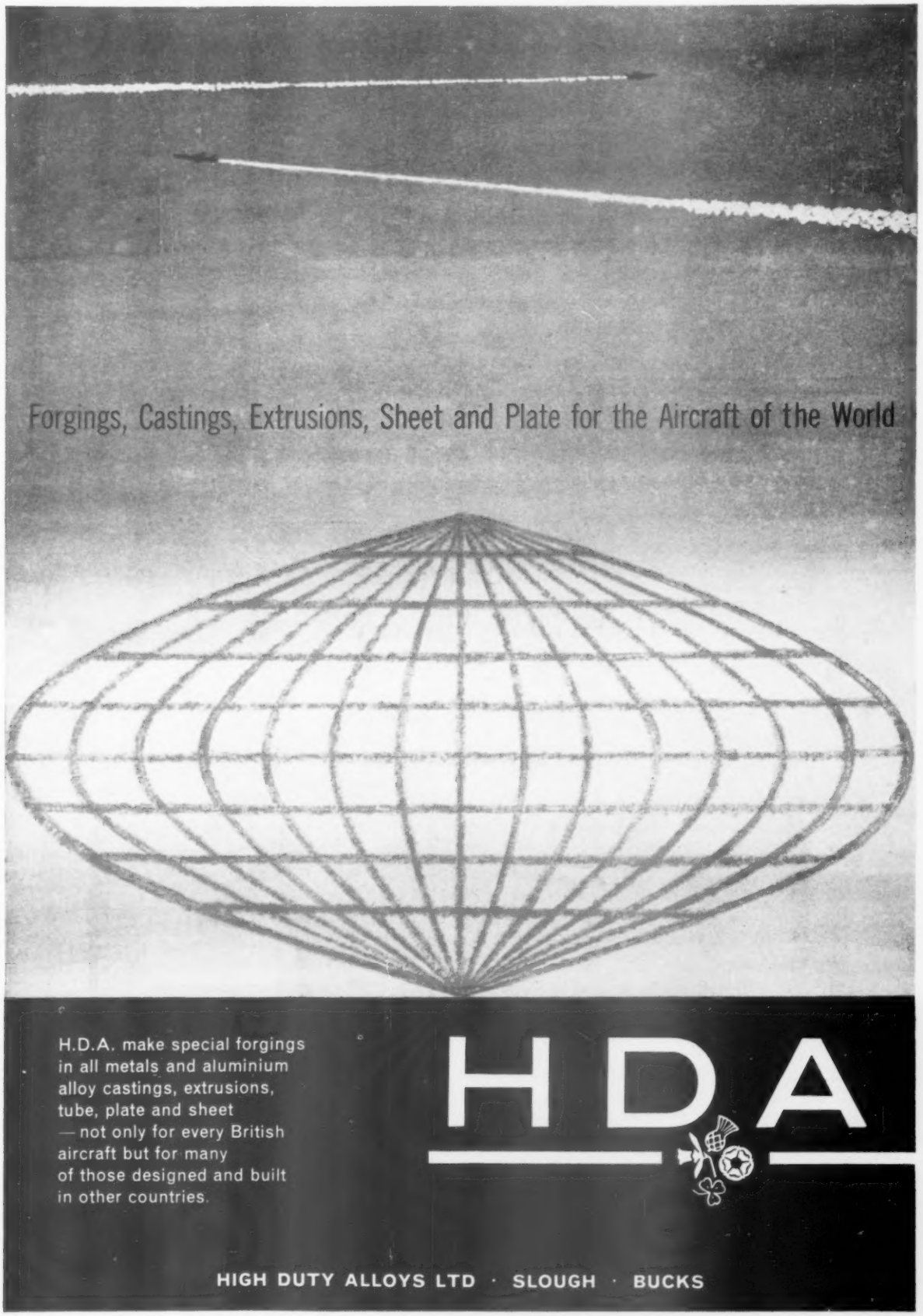
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THE AEROPLANE and ASTRONAUTICS

VOLUME 101 NUMBER 2604 SEPTEMBER 14, 1961

Next Farnborough the Last ?

By the end of this month the Council of the S.B.A.C. will have decided whether the Farnborough Show is to take place next year. The general feeling is that the answer will be "yes"; indeed the president of the Society, the Hon. H. G. Nelson, has forecast that it will take place. This seems as it should be, for there will be a notable new generation of British aircraft on view. The next question that has to be settled with the aid of the replies to the questionnaire which has been sent out to members is the procedure to be carried out thereafter.

First, there is the desirability of accepting the fact that the gestation period of big aircraft is nowadays so lengthy that progress is better measured in periods of two years than one. As this view has already been adopted across the Channel, the question then arises should the Farnborough Show be held alternately with the French International event. Again, the question arises, should the S.B.A.C. Show be internationalized also? There are plenty of those who think not.

On the other hand, equally there are plenty of people, much involved in the business, who think that any product using British equipment of more than a certain value should be eligible. This would let in British aircraft with foreign engines or foreign aircraft driven by British powerplants or aircraft such as the Fokker Friendship which makes use of a notable amount of British material.

Of course there is always the compromise solution, dear to British hearts. How much the public wants its annual air show is shown by the attendance figures. A total of 350,000 has been quoted, of which 180,000 went on the Saturday and Sunday. The programme this year marked a notable step towards what might be described as the Hendonizing of Farnborough. The Fighting Services badly need a show window to publicize their way of life to potential recruits and to the families of potential recruits. And á large open space is needed fo do this.

Miracles are annually performed under cover at the Royal Tournament, but so far not even helicopters have been actually flown under cover there. It is the near-supersonic flying which attracts the crowds to Farnborough.

Could it be that what we shall see will be the classic Farnborough Show alternating with the old-time Hendon Air Display? There is no doubt that British aviation affairs have become used to the Farnborough rhythm.

It must not be forgotten that though there are fewer aircraft construction firms in British aviation, there are more people employed in it than at any time since the end of the War. This tremendous manufacturing effort is reflected in the demand for exhibitors stands at the Show, nearly 400 this year. The question that awaits an answer is whether the manufacturers of equipment will be content with a show every two years in this country. Many of them will find exhibiting at the Paris Show expensive.

In such circumstances, a clear-cut decision about the next-but-one Farnborough Show is not so easy to envisage.

D

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Matters of Moment

More Work for the Industry

IN the course of last week's S.B.A.C. Display, several new orders for British aircraft were announced. The largest, and altogether the most important, was the purchase of five Vickers VC10s for use by R.A.F. Transport Command. These aircraft will be dimensionally the same as the basic civil VC10 ordered by B.O.A.C., B.U.A. and Ghana Airways, but they will be at the newly announced gross weight of 310,000 lb. (and therefore the heaviest aircraft ever operated by the R.A.F.). They will be powered by 21,825 lb.s.t. R.-R. Conway R.Co.42/3 engines, of the type specified for B.O.A.C.'s Super VC10s, and will be equipped for passenger and troop carrying.

The decision in principle to order VC10s was announced by the Minister of Aviation on Sept. 5, following "a review of the Royal Air Force's requirements for strategic transport aircraft." The contract is now being negotiated and deliveries are expected in the early part of 1965. Fifty-seven VC10s have now been ordered, and the latest contract probably represents well over £12 million worth of airframes, engines and spares.

Westland Aircraft were able to announce two helicopter orders, both of which have been carefully "nursed" for some months past. The first, on Aug. 30, was for "a substantial number" of Wessex HC.2s for use by the R.A.F. for transport, freight, ambulance and general duties. This is a variant of the R.N. Wessex HAS.1, with a de Havilland coupled Gnome turboshaft and without the submarine detection and attack gear. A prototype is to fly in the near future with coupled Gnome H.1000s; production aircraft will have the more powerful H.1200s. With a gross weight of 13,500 lb., the Wessex 2 has a payload of 2,770 lb. when carrying its full fuel capacity of 2,400 lb.; the space-limited payload comprises 16 troops or eight stretchers.

The second Westland order was from the Royal Navy for (again) "a substantial number" of anti-submarine Wasps. The latter name has been adopted for the Naval version of the Saro P.531, used by the Army as the Scout. Powered by a Blackburn Nimbus turboshaft, the Wasp will be used off the flight decks of frigates to attack, with homing torpedoes, submarines located by the ships' long-range ASDIC.

Special features will include a folding tail section and special deck-landing gear. The seven Leander-class and seven Tribal-class frigates will each carry one Wasp. Subsidiary rôles include search and rescue, and training.

An order for two Handley Page Herald 200s, said to be worth about £500,000 including spares, was placed on Sept. 7 by Itavia, the Italian independent local operator. An option was taken on a third. Handley Page also announced during the week that the Maritime Central/Nordair order had been increased from two to three, making the present total of firm orders for the Herald 15. Work continues on a batch of 25, and further sales prospects are sufficiently good for the decision to have been taken to order materials for another 25.

An inter-industry deal announced last week was the purchase of the first executive D.H.125 by Bristol Siddeley Engines, Ltd. D.H. has placed a £1 million contract with Bristol Siddeley for 60 Viper 20s for the first batch of D.H.125s.

Several new Comet sales were said to be imminent, among them the Middle East Airlines "optional" 4C which was participating daily in the flying display at Farnborough. On Sept. 8, de Havilland announced that King Ibn Saud of Saudi Arabia has chosen a Comet 4C for his personal use—surely the most expensive and probably the most luxurious privately owned aeroplane in the World. The sale to King Ibn Saud was made in the face of strong competition from Boeing, who last week announced that Saudi Arabian Airways has ordered two 720Bs.

Germany and Europe's Space Booster

THE statement by Mr. Peter Thorneycroft, Minister of Aviation, at Farnborough on Sept. 6, that Germany is to build the third stage of the proposed European heavy satellite launcher, based on Blue Streak, suggests that "agreement in principle" has now become agreement in fact. Thus, prime responsibility for the launching vehicle is now divided among three nations, Britain, France and West Germany, but no doubt other smaller countries will have key parts to play in developing components. There is also the question of payloads.

There now seem to be no barriers to the establishment of the projected European Space Launcher Organisation, although a meeting to draft the necessary convention has yet to take place. It would almost appear that the "big three" have decided to go ahead together without overwhelming support from the other nations involved in the Strasbourg discussions last winter.

Photograph copyright "The Aeroplane and Astronautics"

PRESIDENTIAL APPROVAL.—The Hon. H. G. Nelson, president of the Society of British Aircraft Constructors, watches the flying at Farnborough with evident approval.

The door is, of course, still wide open. The Ministry of Aviation informs us that all the countries represented at Strasbourg are being asked to communicate their views by the end of this month.

One of the smaller nations which will definitely not be joining the European project is Norway. It was announced in Oslo on Sept. 5 that after a close examination of the technical, scientific and financial aspects, the Norwegian Government had decided that participation would not be practical at the present time. Norway, however, would be sending an observer to the conference. The decision is said to reflect a lack of suitable technical personnel and facilities as much as economic considerations.

Similar difficulties may apply to other countries, and some readjustment of the Strasbourg budgetry proposals will be inevitable.

Nyet and Nichevo

A MASTERLY display of evasion and non-committal was the main outcome of a Press conference last week at Farnborough with the visiting delegation of Russian aircraft designers. Headed by the burly and tough Mr. Leschenko, the three-man delegation fenced for nearly an hour with aviation pressmen from many countries, and succeeded in giving nothing away while expressing no concrete opinion on anything they were shown.

The doyen of the trio, veteran aircraft designer Sergei Ilyushin, remained as gnomelike and inscrutable as ever, showing his only signs of animation in refuting queries whether his son had in fact preceded Gagarin into space. His injuries were received, said Ilyushin, in a car crash.

Most sophisticated of the trio, bow-tied Oleg K. Antonov, who speaks both French and a little English, exhibited the sole signs of charm in delivering information to the interpreter, for wrapping-up in the best Russian officialese and diluting down to meaningless platitudes. He did establish the fact that his twin-turboprop An-24 was not yet in service, although soon would be, and that he thought the Avro 748 the most interesting civil aircraft at Farnborough, despite the presence of the Handley Page Herald, which is similar in configuration to his own latest product.

Antonov was also invited by the Soviet chairman to advise on a question on the development of the supersonic transport in Russia, but the answer came out in the standard form that the Soviet Union is interested in all modern technical developments, although the necessity for such an aircraft had been acknowledged. The Russians were very interested in their visit to Farnborough, thought some of the aircraft were very good,

but said that they had many good aircraft in their own country.

Perhaps the only real fact to emerge concerned the designer of the supersonic single-jet Russian delta, designated the E-66 in F.A.I. archives, which has established several World records for speed and altitude. Questioned as to the origin of this aircraft, the delegation put its collective head together and announced that it was the design of fighter king Mikoyan, which is what one would expect (see also p. 348).

Although the Russians did not give out anything in the way of worthwhile information, they must have collected a good deal. They visited the Press tent and collected copies of the many copious technical hand-outs therein. Recorded as they emerged by television cameramen, one of the interpreters in the delegation tripped over a guy rope in his embarrassment, but this was perhaps the only setback during their visit.

It will be interesting to see if any of our aircraft industry leaders are invited to the next Tushino show.

New Soviet Rocket Tests

THE fact that Russia is to make a new series of rocket launchings into the Pacific Ocean between Sept. 13 and Oct. 15 has led to a good deal of speculation on the further space experiments which are now in store. The official *Tass* statement merely indicated that the tests would concern "powerful and improved versions of multi-stage carrier rockets of space vehicles." The impact area is approximately 1,000 miles south-west of Hawaii and within a similar distance of Christmas Island, the Pacific atoll where British nuclear testing has been carried out. The rockets will be launched without their final stages. *Tass* also stated that Soviet ships equipped with special measuring devices will be stationed in the area during the tests.

What this new round of testing heralds in terms of space-development can only be conjectured, but three basic problems are in view. First is to investigate more fully the hazard represented by radiation in space—particularly the radiation belts girdling the Earth and the sporadic emissions from the Sun at times of solar flares. This almost certainly will involve flights deeper into space with instruments, and possibly also recoverable capsules containing dogs or other animals sent around the Moon and back to Earth.

Second is the need to obtain more definitive scientific data of the lunar environment itself, using soft-landing probes. And third, as a prelude to establishing manned space-stations around the Earth, and for refuelling manned spacecraft en route for the Moon, the development of orbital rendezvous techniques. With the latter, it may be possible to send manned vehicles to the Moon without the need to develop the massive 12 million lb. thrust boosters which America now envisages in their Nova programme. If orbital rendezvous experiments are made in the near future, it will strongly support the view which has been gaining ground over the past twelve months that Russia will mount her main assault on the Moon with rocket vehicles which are refuelled in orbit.

Meanwhile, an indication of Soviet interest in manned space-laboratories is in the statement made by Major Gherman Titov in Leipzig on Sept. 4 to the effect that Russia would soon launch a space station for the benefit of international science. "This will enable Russian and foreign scientists to carry out weather observation and other research," he said.

Helicopters and the Army

MIXED company did not prevent Major-General G. P. L. Weston, D.S.O., O.B.E., director of land/air warfare at the War Office, from being blunt with the U.K. helicopter industry on the occasion of the annual dinner in London on Sept. 6 of the Helicopter Association of Gt. Britain—or Rotorcraft Section of the R.Ae.S. as the former pioneering body has become.

Stressing the importance of battlefield mobility, the general agreed the value in this connection of the contribution that VTOL aircraft could make. It was his view that in this field the helicopter would rule the roost for a number of years.

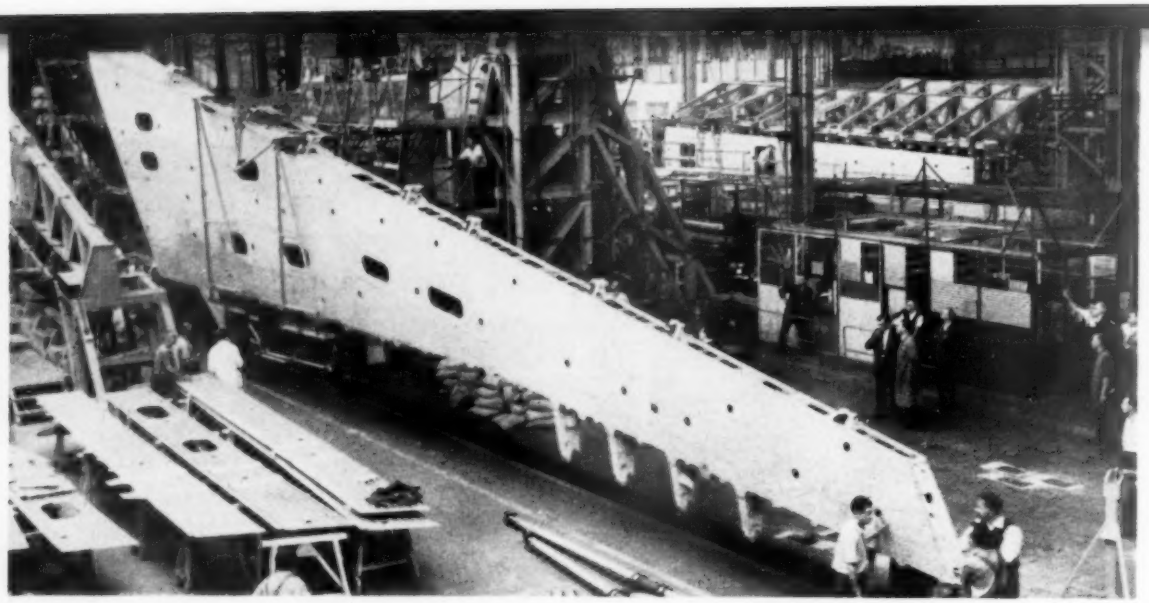
His Service probably had the biggest demand for such machines but had no ambition for a private air force. Their men had to be soldiers first and airmen second. It was their hope that VTOL machines could take the place of some of the Army's general transport vehicles.

Speaking of buying new aircraft he referred to the purchase from overseas of the Alouette and paid generous tribute to its behaviour and its reliability. The U.K. industry must keep its eye on reliability, ease of maintenance and reasonable price.

WG. CDR. R. A. C. BRIE, vice-chairman, taking the place of the chairman, Professor J. A. J. Bennett, absent in the U.S., replied and then proposed the toast of "The Guests." An American visitor, DR. H. GUYFORD STEVER president of the Institute of Aerospace Sciences replied.

A break with tradition, announced by Wg. Cdr. Brie, was the postponement of the awards, normally made at the dinner, to the occasion of the R.Ae.S. Wilbur Wright Lecture (Sept. 12).

DISPLAY ARRAY.—Aircraft set out for inspection on the Farnborough runway during the 22nd S.B.A.C. Display. Despite a paucity of new types, this year's Show—which is fully reported on pages 355 to 383—certainly contained much of interest among the products of the ancillary industry.



MAKING PROGRESS.—Removing the first VC10 wing from its jig at Weybridge last month. It is now being assembled to the prototype fuselage.

Towards a Civil Mach Two

NEWS of progress with Britain's supersonic airliner design was given at Farnborough last week by Dr. A. E. Russell, director and chief engineer of Bristol Aircraft and head of the British Aircraft Corporation team dealing with the project. Their study, he said, would be finished and handed over to the Ministry of Aviation round about the end of the year. Already some preliminary proposals have been put forward in relation to the design.

No details have been generally released, however, but the indications are that the proposed craft will be in the Mach 2 category cruising at 60-65,000 ft. with accommodation for 130 passengers and be powered by conventional—albeit advanced—turbojet engines. That it will be of the slim-delta tailless configuration seems certain—in view of the stated place of the H.P.115 in the associated research programmes.

According to Dr. Russell, if Ministerial sanction were to be given to the building of such a craft soon, it could be flying in 1966 and be operational by 1970. The intention to go ahead beyond the design stage has, of course, not yet been announced.

Dr. Russell is reported to have said that a Mach 3 airliner would never be worth while in civil aviation. Both Mach 2 and Mach 3 designs had been studied; the faster aircraft would be more difficult and expensive to build and would present many other associated problems. The Mach 2 airliner, on the other hand, could be made in aluminium alloy. It would be a little more expensive than current 600-m.p.h. transports—fares on the North Atlantic might be £5 a head more; but to travel at Mach 3 would cost £10 a head more, for an extra time saving of only about half an hour.

Earlier in the week, the president of the S.B.A.C. had said during his speech at the Society's annual dinner, that the study had been made on a co-operative basis between the industry and Government establishments. This, he said, had been "very detailed and very successful." Arising from this a design study for a Mach 2 airliner had been put in hand. The president, however, was careful not to make any disclosures about the likelihood—or otherwise—of the final "green light" being given to go ahead with its building.

Getting VTOL Operational

NO aspect of British aviation requires closer attention at this time than that connected with vertical take-off capability. This country cannot claim the first VTOL aircraft, either in the flat-rising or vertical fuselage categories. However, from the earliest days the great powerplant firm of Rolls-Royce has devoted much effort to the development of special powerplants to achieve VTOL capability and in this connection the name of Dr. A. A. Griffith will be long remembered. The historic Thrust Measuring Rig, vulgarly known as the "Flying Bedstead," first demonstrated its capabilities in August, 1954.

It is unfortunate that a magazine so well informed as the *Economist* should get itself so mixed up as to say, as it did last week, that "vertical take-off means heavy engines"—the truth is, of course, quite the reverse. Only the coming of the extremely lightweight powerplant has made VTOL practicable. It was not until the coming of the turbine that powerplants gave a sufficiently high power-to-weight ratio for thrusts in excess of the aircraft weight in which they were installed to be available to the designer.

Following the pioneer work by Rolls-Royce we have witnessed the development of the alternative concept by Bristol Siddeley in which a single engine, provided with a high bypass ratio and four swivelling outlets, can provide vertical lift or translational thrust at the wish of the pilot.

For the past two years, the Rolls-Royce VTOL engines have performed at successive S.B.A.C. Shows, demonstrating in the S.C.1 that a flat-rising delta aeroplane can perform like a helicopter or high-speed fighter at will. The Bristol Siddeley concept, with much less development behind it, has been installed in two advanced Hawker machines, obviously capable of much more sophisticated behaviour than the S.C.1, but with which the gap has yet to be closed between the slow speed regime with deflected thrust and the normal performance which begins above the 130 m.p.h. stalling speed.

Once more attention must be drawn to the remarkable situation which exists. VTOL potentiality has been demonstrated, but the Services have no means of seeing how it works in the field. This is not because the Services do not want to try out such devices but because too many cooks are involved in the technical broth.

Let us recall that at the beginning of the year (on March 23) we wrote that no one who takes an interest in such things can doubt that the coming of VTOL capability must change the whole business of using military aircraft in the field. But so far no aircraft capable of immediate military application exists. One consequence of this is that operational units have no idea of what could be done with such aircraft.

It is a matter of observation that the adoption of any revolutionary idea takes a very long time. Human beings are by nature conservative and in general a defensive attitude is adopted against any new thing blown their way by the wind of change. Only as new things become available and can be proved in practice does their adoption begin to increase.

One of the proven ways of getting a new idea accepted is to make examples of it available for testing. We went on to say that it would not be reasonable to expect professional Service officers to lay down operational requirements for aircraft the characteristics of which are completely unfamiliar to them. Such problems as type of powerplant cannot be solved until operational experience has been obtained with such types as exist. Some means must be found to provide the Services with examples to try out.

Let us again suggest that some way must be found of establishing a Vote in the Estimates which can be applied for the purchase of promising developments. Such promising developments would in due course be made available to Service establishments so that Service pilots could try them out for themselves. The world "evaluate" has not been used since it suggests trying something out against an existing set of standards. New ideas can be so revolutionary that existing standards can be useless.

If such a Vote did exist we should not now be faced with a situation where the potentialities of a practical VTOL flat-rising aircraft are completely unknown to the pilots of the Royal Air Force, Navy and Army. With only three VTOL aeroplanes flying they cannot be expected to know. How much longer must the Services wait to get operational experience with existing designs?

OPtional Reading—11

TWO weeks ago I wrote principally of Aeroflot in the international field; this week we will look at the domestic position. Here, most factors favour a rapid expansion. First, plenty of suitable aeroplanes are becoming available both in the long-haul and in the short-haul categories; secondly, plenty of cheap fuel is available, enabling costs to be brought down (already on some sectors) to the level of rail transport; thirdly, rouble-paid travel is a satisfaction which the existing dispositions of Soviet economy can offer more easily as a token of a rising standard of living than it can consumer goods—400 roubles' worth of flying hasn't the same social nuance as has 400 roubles of "self-property." And with wife and husband working often hundreds of miles apart, social visits have a significance unknown in the West. So demand and supply are both abundant in the domestic market.

Anticipating this, the current seven-year plan calls for 65 new airports by 1965. Probably the aerodromes themselves will emerge, but I have grave misgivings about the buildings and supporting facilities. The terminals at Vnukovo, Leningrad, Sochi and Tbilisy are already swamped. However, these have the excuse of some years of standing: the significant point is that the new international terminal at Sheremetyevo is looking inadequate within a year of its opening. Domodedero is due to open next year, but my guess is that, if it is to cater for domestic as well as for international traffic, it will be overtaken by events. It seems that the characteristic of "too little and too late" is as common to Soviet airport planners as it is elsewhere. However, lack of terminal buildings will not stop the rise in domestic traffic. The folk will camp out if necessary; or the system of direct transport from town office to aircraft, already successful at Leningrad, will be greatly extended.

A more difficult problem will be the extension of air traffic control facilities. At present this service depends to a very great extent on radar coverage. This is fine when there are only three or four aircraft on the scope, but it becomes hopeless to try to vector 30 or 40, and some form of self-contained aid will be essential. At present the only en route navigational aids on board are the radio compass, fan markers and terrain mapping radar. VOR does not yet exist—though probably it will be available in a year or two. The pilots report that the radio compass (which has a dial about 7 in. in diameter) is accurate "to half a degree": they get over the problem of thunderstorm interference by the combined use of airborne radar for cell avoidance and ground-radar vectors for track-keeping. But clearly this will not see them through into a period of real high-density traffic, and one can only hope that a new system, more suitable for airways flying and dense terminal areas, is in the offing.

Worth more than a passing note is the anti-collision radar, now common to all the larger aircraft types. This has a four-inch dial side by side with the weather radar (under the same hood), giving a sweep of 60° on each side of aircraft heading and 30° up and down. If I understood my interpreter correctly, it gives a warning at 30 naut. miles range and if, after a pause for pilot response, no change of heading is made while the bearing of the target remains constant, a turn is signalled to the auto-pilot. Sounds too good to be true! If the above is correct, it would be worth the U.S.S.R. putting a few hundred on the foreign market. Or perhaps an enterprising Western manufacturer will take out a licence? I failed to bring home any literature on the device, but am still hopeful.

Somewhat more obscure is a 2-in. dialled radar scope showing a ¼-in. grass diameter with two or three ½-in. vertical blips at one end; these were stationary when I looked. A rather similar display, but with a T-shaped blip, was seen in one of the towers and explained as identification radar. But if the similar-looking airborne device had anything to do with this, why did it need a display at all? Perhaps one of our electronics friends can account for this.

And now a brief word about the crews. The standard crew for the Tu-104 and Il-18, which at the moment account for the bulk of the domestic trunk routes, is two pilots, one navigator, one flight engineer and one radio operator (the latter using W/T or R/T as appropriate); a third pilot is never carried except for training purposes. They stay as a team for perhaps one or two years; while on service, they sleep five in a room at (apart from this limitation of space) well-appointed rest houses situated near the airport and supervised by a doctor (75% of doctors are women in the U.S.S.R.); fly a maximum seven-hour day; earn (a captain of a Tu-104 on "average"-type route, at 60 hours a month, with full safety bonus) 676 roubles per month. (From the shop windows, it looks as if a suit of clothes costs 75-100 roubles.) Co-pilots on jets earn 70% of a captain's pay and 60% on pistons; for navigators these figures are respectively 75% and 60%.

All airport managers, wing and squadron chiefs are pilots or ex-pilots. As one of them said to me: "We consider that, in the jet age, the operational side should dominate; with sound and safe operations, the financial side calls for only average administrative ability." Obviously he had been studying OPtional Reading 1 and 2!

Incidentally, all Soviet crews are convinced that Major Gagarin piloted his capsule to earth without damage. I give a good deal of weight to information from this source.—C.C.J.

C.F.S. American Tour

A TEAM of seven officers from the Central Fighter Establishment, R.A.F. West Raynham, are to leave the United Kingdom on Sept. 17 for a four-week visit to U.S.A.F. bases in the United States. They will be led by Air Cdre. E. G. L. Millington, Commandant of the C.F.E., who will be accompanied by Wg. Cdr. D. W. B. Farrar, of H.Q., Fighter Command.

Object of the visit is to discuss air defence matters, weapons development and tactical evaluations with the North American Defense Command. During their tour, which will take them to Edwards, Nellis, Eglin, Tyndall, and Wright Patterson Air Force Bases, members of the team will visit the Headquarters of the U.S.A.F. in Washington, Tactical Air Command, and aircraft and weapons manufacturers.

F.A.A. Basic Helicopter Training

AT present completing their initial 75 hours' flying experience on Provosts at R.A.F. Linton-on-Ouse, 24 Royal Navy and Royal Marine helicopter pilots for the second Commando carrier H.M.S. "Albion" are to receive their basic helicopter training from British United Airways.

As the first civil airline ever to provide flying instruction for Fleet Air Arm pilots, B.U.A. will operate six courses of four pupils each over a period of 43 weeks at Redhill, using Hillers and Whirlwinds. On completion of their course at Redhill, the F.A.A. pilots will go on to R.N.A.S. Culdrose to receive tactical training before joining "Albion," now being converted for her new rôle.

The provision of this second Commando carrier in the fleet has meant a temporary increase in the number of helicopter pilots required by the F.A.A. It has, however, been considered uneconomical to expand existing Service helicopter training facilities for the short period involved. At the present time approximately 60 helicopter pilots a year are trained at R.N.A.S. Culdrose.

Under a recently introduced scheme to provide the Royal Marine Commandos with a proportion of their own aircrew, officers of the Corps are now specializing as helicopter pilots. The first R.M. helicopter pilot, Lieut. R. Learoyd, joined H.M.S. "Bulwark" as a member of No. 848 Squadron last month.

Low-price Procedure Trainer

A RELATIVELY new company—Electronic Control Engineering, Ltd., of Burgess Hill, Sussex, which was formed only about 18 months ago—is about to ship the first of its production procedural flight simulators to Finland for use by that country's air force. This—a single-seat version based on the Fouga Magister—is one of the ECE/60 series of ground trainers which have been designed to meet present-day synthetic training requirements at a very economical price.

The basic trainer incorporates an analogue flight and radio-aids computer, and track and approach recorders, and provides automatic simulation of ADF, VOR and ILS facilities. It is suitable for ab initio training, instrument rating checks and navigational and approach procedure training. The cockpit of this first series of trainers is representative of a fast jet trainer aircraft, but other variants can be fitted with instruments and controls to the customer's choice, and the computer can be calibrated to simulate the performance and characteristics of a wide variety of aircraft.

The trainer is compact and has only three main units—the cockpit or flight deck simulator with electro-mechanical analogue computer, power unit and servo assemblies; the radio aids console, with 25-in.-square map and track recorder; and the main control console for setting up the exercises and selecting problems and failures. These units are set in a semi-circle around the instructor, who has a continuous view, through a shielded glass panel, of the pilot's instruments.

Aviation News in General

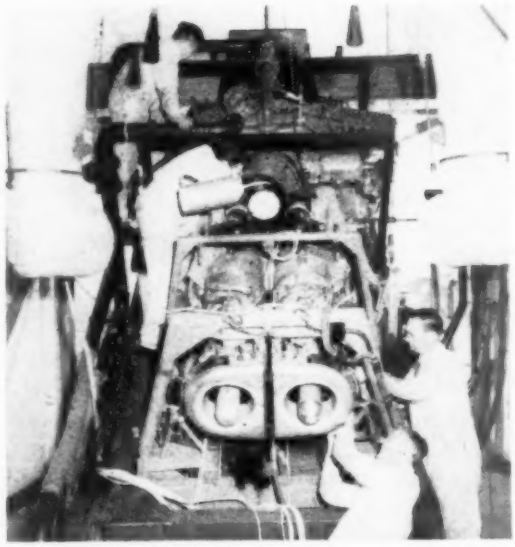
HOVERCRAFT FLIGHT.—First "flight" of the Britten Norman Cushioncraft CC2 (G-ARSM) was made at Bembridge, I.o.W., on Aug. 31. Powered by a Rolls-Royce V-8 automobile engine, the CC2 has accommodation for 10 in an enclosed cabin.

MARCONI NEWS.—Already ordered for the Mirage IV, Marconi Doppler navigators of the AD2300 series have now been specified for the Dassault Mirage III. A substantial order has been placed with Marconi by the French Government. Other news from the company is that its Sixty Series VHF communications equipment AD160, on order both for B.O.A.C.'s VC10s and B.E.A.'s Tridents, has successfully completed tropical flight trials in a Hastings.

CORONADO FUTURE.—A programme of wind-tunnel testing is being conducted by the Cornell University to determine the cause of excessive drag on the Convair 990. Modifications to the outboard engine pylons made since the first flight have cured a flutter problem, but the aircraft is reported to be unable to meet guaranteed performance.

MET. RADAR.—Decca Radar has announced the addition of three new weather radars to its existing series. Two of these, Types 42 and 43, operate in the 3-cm. band. The third, Type 44, is 10-cm. equipment. The Type 43 has been specially designed to provide a range/height indicator display in addition to the usual 12-in. P.P.I. presentation.

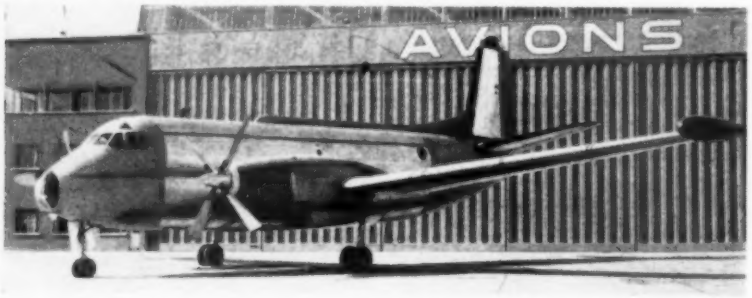
RECORD MAKER.—The F.A.I. has confirmed as a World record for aeroplanes the altitude of 34,714 m. (113,891.5 ft.) reached by G. Mossolov of the U.S.S.R. on Apr. 28, 1961, in an aircraft known as the E-66A. This is described as an all-metal delta-wing monoplane with a 6,000 kg. (13,227 lb.) thrust "TDR marque R 37F" engine and a 3,000 kg. (6,613 lb.) thrust "GRD marque U 2" engine. The latter is presumably a rocket unit, and the aircraft may therefore be the Mikoyan delta type known as Fishbed (see our issue for Aug. 10).



WESSEX POWER.—A coupled D.H. Gnome H1000 shaft turbine under test at Hatfield before its installation in the prototype Wessex HC.2. This helicopter will later be fitted with coupled H1200s (see page 344).

VULCAN BOOST.—The first Vulcan B.Mk.2 with four 20,000 lb. Bristol Siddeley Olympus 301 engines is now being test flown from Woodford. The conversion was made by Gloster Aircraft Co. Olympus 301s will be introduced on the production line in due course.

CAPSULE RESCUE.—After orbiting the Earth for two days, the gold-plated re-entry capsule of Discoverer XXIX was commanded to return on Sept. 2. It descended into the sea north of Hawaii and was recovered.



A.S.W. PROTOTYPE.—The Tyne-powered Breguet 1150 Atlantic maritime reconnaissance aircraft for NATO air forces after its recent roll-out at Toulouse-Colomiers.

BEAGLE SUCCESS.—According to Peter Masefield, the Beagle Group received "firm" inquiries for about £1 million's worth of aircraft during Farnborough week. About a hundred aircraft were covered by potential sales, from the Beagle range of Airedale, Terrier, B.206, M.117 and M.218. Some 50% of the inquiries were from overseas. The B.206 executive twin had met with "a tremendous response."

S.E.M.C.A.-TEDDINGTON LINK.—Under an agreement with Ateliers S.E.M.C.A. of Toulouse, Teddington Aircraft Controls is now able to supply the range of air-conditioning and pressurization equipment produced by the French company to customers within the U.K. and Commonwealth.

MERCURY DELAY.—Technical difficulties were still holding up the launching of the unmanned MA-4 Mercury capsule at Cape Canaveral at the time of writing. The Atlas-boosted orbital mission, originally planned for the week ending Aug. 26, was re-scheduled for this week.

SPACE AGREEMENT.—The British Aircraft Corporation and Minneapolis-Honeywell Regulator Company have announced that they are to form a joint organization to develop, manufacture and market inertial guidance systems for aircraft and missiles in Europe. To be known as "Inertial Guidance—Europe," the organization will have its headquarters in Paris. It will be staffed by members of both companies.

Commercial Aviation Affairs

PROBLEM IN JORDAN.—On Aug. 30 all operations by Air Jordan were suspended by the Directorate of Civil Aviation on the grounds that its DC-6 had made an unauthorized flight from Cairo to Stanleyville, allegedly carrying an illegal cargo. A new airline known as Jordan Airways has been set up by Government decree, with a temporary licence to operate on four routes from Beirut. Commercial and technical operations are being assisted by Middle East Airlines, whose Viscounts are operating the total of 11 round trips a week. This new operating company apparently is distinct from Jordan National Airways, which was licensed on Jne. 21.

THE TRAFFIC SQUEEZE.—Because of poor load factors Lufthansa is considering re-routeing its present Munich-Cologne-New York service via Frankfurt instead of Cologne, which would then be a stop on the Hamburg-New York service. Weak traffic-generating areas would thus be linked with the strong ones—Hamburg and Frankfurt.

BOEING BUY.—Two Boeing 720Bs have been ordered by Saudi Arabian Airlines for use on its Middle East routes. Delivery will be made before the end of this year, work on the aircraft having been started against Ethiopian Air Lines' order. The latter company does not now want delivery of its two 720Bs until later in 1962, when the new Addis Ababa airport will be ready.

DOPPLER APPROVAL.—After a six-week trial by T.W.A. using Doppler navigation system in 12 Boeing 707s on the transatlantic route, the F.A.A. has given the aid "approval in principle." Final approval depends on "satisfactory completion of a pilot training programme and a refinement of procedures."

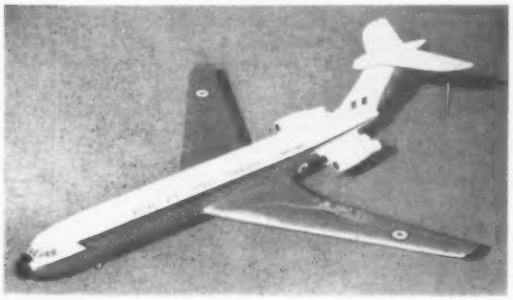
SABENA CARAVELLES.—In the six months since the Caravelle VI went into service with Sabena (on Feb. 18), the airline has provided 1,786 Caravelle flights totalling 4,818 hr. All eight Caravelles are now in service. They have carried 87,171 passengers, each of whom travelled, on average, 785 miles.

FORTY-FOUR PROGRAMME.—Canadair, Ltd., is committed to building 10 CL-44s (at the new gross weight of 210,000 lb.) in addition to the 12 already produced for the R.C.A.F. and the 17 ordered by Flying Tiger, Seaboard and Slick. Canadian Govt. has guaranteed to pay for five if they are not sold commercially, and two others are likely to be purchased by Slick to double their fleet. A re-order by Flying Tiger is also under consideration.

NEW ZEALAND AMPHIBIANS.—Tourist Air Travel, Auckland, have bought Amphibian Airways of Invercargill and, with four Grumman Widgeons, are now the sole N.Z. operators of amphibians. Following a recent American visit to operators of American and Canadian amphibians, Fred Ladd, chief executive/pilot, says that T.A.T. will convert from their present 200 h.p. Ranger engines to 240 h.p. Continental Ms.

AIRSAF SERVICE.—A twice-weekly service between Hurn and Dublin and Belfast is to be maintained throughout the winter by Air Safaris, Ltd. Other Airsaf scheduled services are being suspended until next spring, when, the company says, new equipment will be available.

P.A.L. CHANGE.—The Philippine Government is to sell its majority interest in Philippine Air Lines and thus withdraw its control over the company.



AIRCRAFT ORDER.—An impression of the VC10 as it will appear in Transport Command markings. As noted on page 344 five have been ordered for the R.A.F.

P.I.A. PROFIT.—Pakistan International Airlines continues to make effective economic progress. The net profit for its financial year ended Jne. 30, 1961, was about £750,000 despite flight-crew and engineering training which have involved costs of more than £355,000 during the past two years. In the first six months of 1961 a high average (89%) of on-time departures was recorded.

JUBILEE MAIL.—On Saturday, Sept. 9, a B.E.A. Whirlwind helicopter carried 42,000 envelopes and 7,000 post-cards from Hendon to Windsor Great Park in commemoration of the first British air mail service in 1911 over this route. A golden jubilee dinner, with Viscount Samuel (who, as P.M.G., sanctioned the service in 1911) as principal guest, was held in the evening.

PILOT SHORTAGE.—Faced with an acute shortage of pilots, Aer Lingus is expected, in the near future, to set up its own training school—probably on the general lines of the College of Air Training at Hamble.

FINED.—The maximum penalty of $1,000, imposed under the Federal Aviation Act, has been paid by a passenger who became intoxicated from his own alcohol supply on a U.S. aircraft last March (see our issue for Aug. 31).

ACCIDENT REPORT.—The C.A.B. report of an investigation into the accident to an American Airlines Electra at La Guardia a year ago says that the pilot "failed to plan his approach and estimate the aircraft's height above the ground properly."

ETHIOPIAN ACCIDENT. — Four passengers and a stewardess were killed when an Ethiopian Air Lines DC-3 crashed on Sept. 5 shortly after take-off from Addis Ababa for Asmara on a charter flight. Eleven other occupants survived the crash.

News About People

COMMITTEE MEMBERS.—Mr. W. Martin-Hurst, a director of the Rover Co., Ltd., has been appointed to the Welsh Advisory Committee for Civil Aviation. Two new members of the Northern Ireland Advisory Committee are Air Marshal Sir George Beamish (in succession to the late Mr. J. W. Haughton) and Councillor S. R. Cochrane.

ELLIOTT DIRECTORATE. — Mr. David Ince, well known as a glider pilot, has been appointed to Elliott Automation's directorate of overseas operations as assistant director, aviation and military. He has held the positions of divisional manager of the servo components and guided weapons divisions of Elliott Brothers since 1958.

DOWTY RETIREMENT. — Lt.-Gen. Sir John Evetts is to retire from his directorship of Dowty Fuel Systems on Sept. 30. This is to allow him to devote his time to furthering the aims of the Three Counties Industrial Education Association of which he is president and chairman of the council. Sir John entered the industry in 1951 when he became managing director, and later chairman, of both Rotol and British Messier. These two companies became part of the Dowty group in 1958. Prior to this he spent five years in Australia heading the bodies responsible for building and developing Woomera and the Research and Development Establishment, Salisbury.

ENGINE ORDER.—Signing of the £1m. Viper contract, also recorded on page 344, by Sir Arnold Hall, managing director of Bristol Siddeley Engines, left, and Mr. H. G. Sturgeon, managing director of de Havilland Aircraft.

PLESSEY MANAGEMENT. — The Plessey Co. announce that Brig. J. D. Haigh has become general divisional manager of its wiring and connectors and capacitors and resistors division, also of Preformations, Ltd. Since February, 1960, he has been manager of the latter division.

CAMBRIAN APPOINTMENT.—Mr. Frank Clark has been appointed personal assistant to Wg. Cdr. L. B. Elwin, A.F.C., managing director of Cambrian Airways. For the past four years he has handled Cambrian's public relations while on the staff of Alfred Bates and Sons, Ltd.

COACHMAKERS' COURT. — Four new officers were elected for the ensuing year at a meeting of the court of the Worshipful Company of Coachmakers and Coach Harness Makers, held on Sept. 1. They are: Col. G. A. Norris, Master; Mr. P. S. Croall, senior warden; Lt.-Col. R. T. Harris, renter warden; Mr. P. N. Dickson, junior warden.

ROBERT GROSS.—We regret to record the death of Mr. Robert Gross, board chairman and chief executive of the Lockheed Aircraft Corp. on Sept. 3 in Santa Monica at the age of 64. He purchased the company in 1932 for $40,000.

Air Transport

T.W.A. Buys the Caravelle

ORDERS for the Sud Aviation Caravelle rose to 142 last week with the announcement of the $100 million T.W.A. contract for 20. T.W.A.'s decision to buy the Caravelle was taken in principle some time ago, but financing the deal has delayed the formal announcement (see our issue for Aug. 24). There is an option on 15 more. The T.W.A. Caravelles, for delivery between January and July 1963, will have slightly longer fuselages than the present series, and will be powered by 16,100 lb.s.t. General Electric CJ-805-23C turbofan engines.

According to a recent note from Douglas Aircraft (U.S. sales and service agents for the Caravelle) this version is now known as the Caravelle XA; it previously had been known as the Caravelle VII. T.W.A. refers to this 68/85-seat version as La Nouvelle Caravelle. The CJ-805-23C engines are at present being flown in the Caravelle III (short fuselage) "Santa Maria" which General Electric purchased last year. It first flew with the new engines on Dec. 29, 1960, and was demonstrated at the Paris Aero Show earlier this year.

T.W.A. is the fourth of the "big five" U.S. airlines to contract for short/medium haul jetliners. Three others—American, Eastern and United—have all ordered Boeing 727s, although United also has put the Caravelle VIR into service this year to achieve a competitive advantage. Among other things, delivery dates were probably an important factor in T.W.A.'s choice of the Caravelle; it is unlikely that Boeing, de Havilland or the British Aircraft Corporation could have undertaken to supply as many as 20 727s, Tridents or One-Elevens by July, 1963. T.W.A.'s jet fleet, delivered or on order, now totals 93.

The sale of Caravelles to T.W.A. brings Sud almost to the end of its initial batch of 150 aircraft. Production of a further 50 was recently authorized, with Government approval. If all existing options were to be taken up, sales would total 189.

Latest data for the Caravelle XA from the makers include the following, with comparable figures for the Caravelle VIR in parentheses: overall length, 108 ft. 0 in. (105 ft. 0 in.); gross weight, 114,640 lb. (111,200 lb.); max. landing weight, 109,130 lb. (104,720 lb.); max. zero fuel weight, 85,980 lb. (81,570 lb.); cruising speed, 429 knots at 32,800 ft. and 99,000 lb. weight (440 knots at 32,800 ft. and 92,500 lb.); max. payload, 19,850 lb. (18,300 lb.); range with max. payload, 1,460 naut. miles (1,420 naut. miles) with 7,500 lb. (6,500 lb.) reserves; take-off distance required, 6,400 ft. (6,725 ft.).

Heralds for Italy

FIRM orders for the Handley Page Herald rose to 15 last week with the purchase of two by the Italian independent scheduled operator Itavia. Signing the Heads of Agreement at Farnborough on Sept. 7, Dr. Guido Mancini, general manager of Itavia, said that the Herald 200 had been selected after extensive study and comparison with all other similar types available. It had been found to have a lower break-even load factor (as little as 37%) over the company's routes than any other type considered, and its passenger appeal was good.

Itavia—Societa di Navigazione Aerea—is based at Rome and operates domestic services to Genoa, Pescara and Siena. The present fleet consists of two de Havilland Herons. Delivery of the Heralds is scheduled for January and February, 1963. An option has been taken on a third aircraft, the total value of the contract, including spares, being over £500,000. The sale of Heralds to Itavia was negotiated through Travelair, Ltd., the exclusive U.K. purchasing agents for the airline.

Other Herald orders are from B.E.A. (three Series 100), Jersey Airlines (six Series 200), North-South Airlines (one Series 200) and Maritime Central Airways (three Series 200 and an option on five).

Focus on Luton

A ONE-DAY conference was held at Luton Airport last Friday, Sept. 8, with the purpose of drawing attention to this airport's facilities and to discuss its possible development. There were five speakers—in addition to Dr. Charles Hill, M.P. for Luton, who opened the conference—and the subjects included the airport itself, its present facilities and future development; scheduled passenger service and air freight prospects; charter operations; and the airport as an aid to exporters.

Opinion at the conference seemed to tend towards the view that Luton might best concentrate—at least for the present—on the encouragement of charter and executive operations. One of the speakers, Mr. Peter W. Brooks, fleet planning manager of B.E.A., said that it was particularly important for Britain's scheduled air network that the "nodal traffic points" should be carefully selected.

Luton has a 5,532-ft. runway which could, if necessary, be extended to 6,700-plus ft. and is equipped with modern night lighting, including visual glide-path indicators, D/F and radar.

Falcon Fined

CAPT. M. KOZUBSKI and Falcon Airways were fined a total of £300 last week for infringements of regulations during Atlantic operations between British Guiana and Gatwick with a Constellation last March (see last week's issue, p. 298).

The planned route to the U.K. from Gander, Newfoundland, via Greenland and Iceland, was changed to a more direct one on which (because the aircraft would be more than 90 minutes' flying time from land) a full complement of dinghies for the 68 passengers was required. Although LORAN long-range fixing equipment had been fitted, its performance was "unsatisfactory."

B.O.A.C. Central

NOV. 13 is the date fixed for the start of B.O.A.C. passenger operations from the partially completed long-haul terminal (No. 3 Passenger Building) in Heathrow's central area.

All B.O.A.C. departures will be handled there, but, for the time being, arrivals will be handled through the international section of the short-haul terminal (No. 1 Passenger Building). Initially only the management and passenger section of B.O.A.C.'s London Station will be transferred to the new building, where office accommodation will be very limited until its completion next year.

DC-8 Development

THE Douglas DC-8 which recently achieved a true air speed of just above Mach 1 (see our Aug. 31 issue) had been modified to have the new "4° wing" and is one of the four ordered by Canadian Pacific Airlines. Supersonic speed was reached in a shallow dive at 40,350 ft. during flight testing of the new wing, the chord of which had been extended by 4% by a root-to-tip extension of the leading edge (see our issues for Nov. 4 and Nov. 25, 1960).

All C.P.A. DC-8s are powered by 17,500 lb. Rolls-Royce Conway R.Co.12 engines. Commenting on the supersonic flight, Mr. Grant McConachie, president of C.P.A., said that this DC-8 has the most advanced wing available and that "results have greatly exceeded our expectations." C.P.A. will offer the fastest and the only non-stop jet service between North America and the Orient when DC-8 service is inaugurated between Vancouver, Tokyo and Hong Kong in November. Following delivery of the first modified DC-8 in November, C.P.A. will have its other three DC-8s modified.

The Shannon Accident

AT about 03.53 hrs. on Sept. 10 a DC-6B of President Airlines, a U.S. non-scheduled operator, crashed just after take-off from Shannon Airport. The 77 passengers and six crew lost their lives.

The aircraft was on a charter flight from Dusseldorf to Chicago carrying a party which was to have spent three weeks in America studying agricultural methods. It had apparently taken off normally from runway 24 and crashed almost immediately afterwards into the Shannon River.

Air-freight Facts of Life

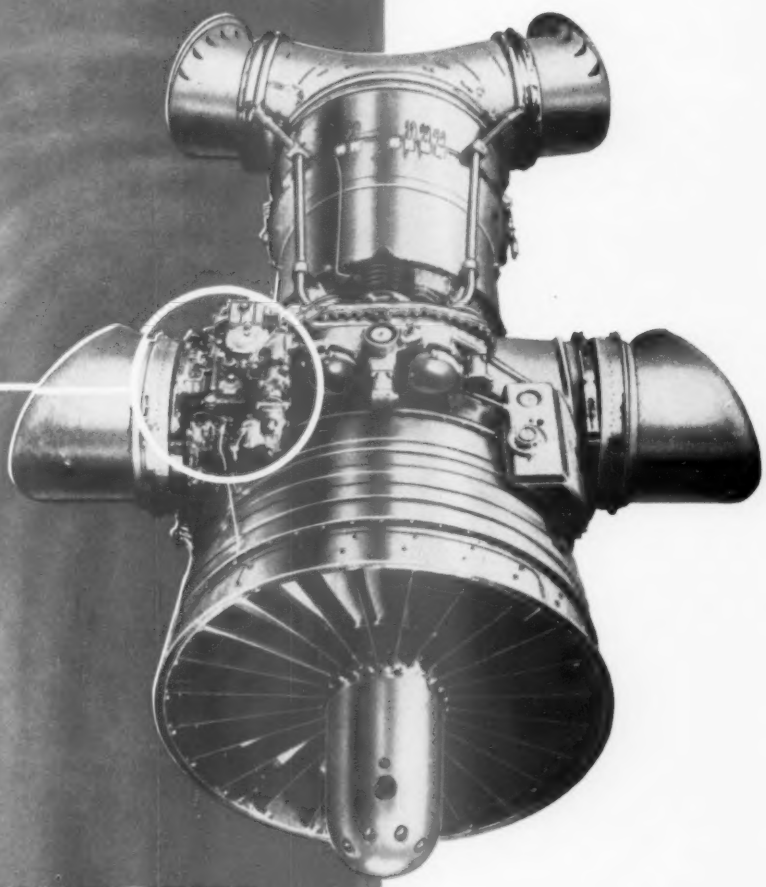
AVERAGE rates for air cargo will need to come down to 10 cents/ton-mile before the business is able to make "significant inroads" in relation to surface transport. New turboprop equipment should make possible rates in the 13-15-cent levels while allowing for a reasonable profit. Further reductions will be possible only by the technical simplification of aircraft and by a very close scrutiny of indirect costs.

These were points made during a recent talk by Mr. K. H. Larsson, of Canadair, to the Transportation Research Forum in New York.

So far as U.S. domestic surface and air traffic is concerned the average yields in 1960 ranged between 65 cents/ton-mile for first-class air passengers and 1.5 cents for long-distance freight rail transport, with trunk fill-up and all-cargo rates averaging 22 cents/ton-mile and inter-city road transport averaging 6.7 cents/ton-mile. Freight revenue of the U.S. domestic trunk carriers averaged only 3.9% of the airlines' total

(Continued on page 351)

POWER FOR LIFT AND THRUST



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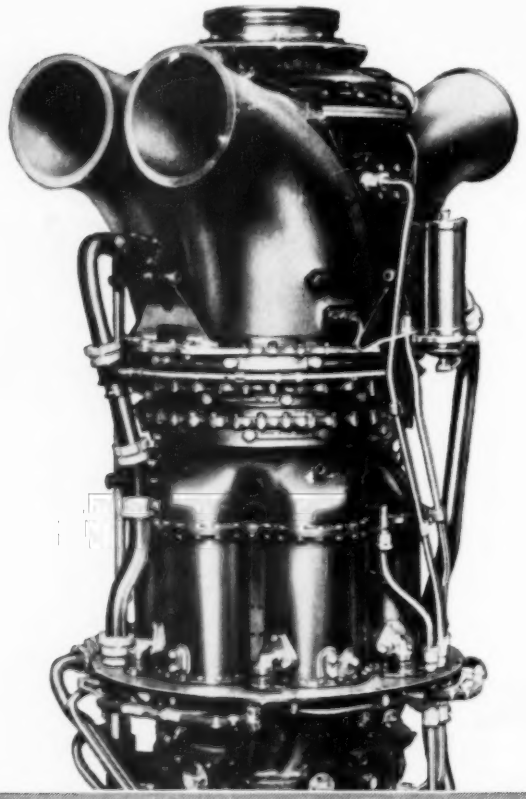

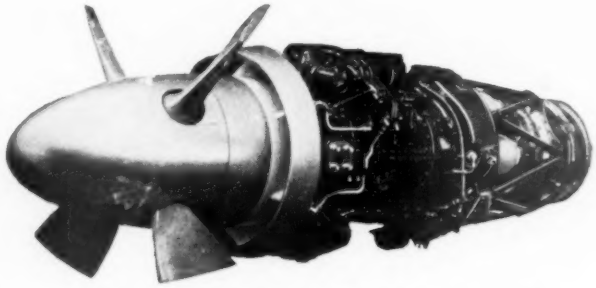

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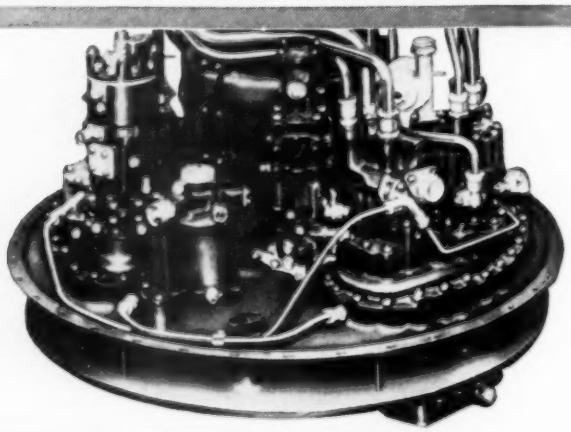

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SKYWAYS STYLE.—This first production Avro 748 will be used later this month by Skyways for a programme of route proving trials, with full certification expected to follow in October. First airline deliveries will be to Aerolineas Argentinas, with Skyways and B.K.S. receiving their aircraft in time for operation next spring.

Air Transport . . . .

(*Continued from page 350*)

revenue, and freight revenue ton-miles averaged only 9.7% of the total ton-miles in 1960.

Although the indirect costs in passenger operations have been generally assumed to be about 100% of direct costs, this ratio should be reduced for all-cargo carriers to 60-70% by the elimination of services necessary for the passenger side of the operation. Even with the lower direct operating costs of larger aircraft, increases in traffic volume will (assuming the same total annual indirect costs) cause the ratio to drop still further.

The promise of further improvements in air-cargo economy is related, in Mr. Larsson's view, to "the fact that cargo aircraft and air carriers have inherited too much complication and sophistication from the passenger services and are still saddled with costs not necessary in pure cargo operation.

"A lot of soul searching," Mr. Larsson continued, "is required by our engineers to rid the future cargo aeroplane of anything that increases costs without contributing efficiency or suitability as a freight vehicle. I suggest that the present trend in systems design and aerodynamic gadgetry (flaps both in leading and trailing edges of the wing, spoilers, etc.) has gone too far and calls for simplification of the cargo aeroplane. I would even go so far as to suggest that a review of our present certification standard, for the purpose of introducing a special category for cargo aircraft, is desired."

RUSSIAN FEEDER.—In the same size bracket as the Avro 748, the Antonov An-24 is expected in service with Aeroflot next year. Its salient features are seen in this model.

Canadair is involved in a comprehensive research programme designed to assist the industry in developing the air-cargo market and to help itself in assessing the market's aircraft needs. With the help of computers, the quantitative part of the research work has been completed. In this, total trade statistics have been tabulated in terms of commodity movements; air movements have been compared with surface movements; and tariffs have been analysed in relation to total distribution costs.

The qualitative programme, now being done by a research organization in co-operation with some 10 other aviation companies, involves the identification of the air cargo potential at various rates and the forecasting of possible growth during the next decade.

Air Ceylon's Future

CONTINUATION of Air Ceylon's international services in association with some other airline has not been ruled out, following K.L.M.'s announcement (see our issue for Aug. 31) that it will suspend the present arrangement with Ceylon on Oct. 31. The decision, writes a correspondent in Ceylon, has been attributed to K.L.M.'s introduction, from that date, of DC-8s on its Eastern and Far Eastern services. Neither of Ceylon's principal airports is large enough for the DC-8 but K.L.M. presumably would have continued its Electra service if Ceylon had been willing to share in the losses.

Mr. P. B. G. Kalugalla, the transport minister, was to have discussions in India earlier this month to explore the possibility of an agreement with Air India International. The Ceylon Government is reported to have decided not to subsidize Air Ceylon operations, however, and the Cabinet sub-committee concerned with the airline's future has asked the management to submit detailed plans for the development of its domestic and regional services.

The Unconsidered Passenger

AN anti-monopolistic letter in *The Times* of Aug. 29 provided a dismal picture of the effects of the over-high average load factor on B.E.A.'s domestic trunk routes. The writer's London company has offices in Manchester and Glasgow.

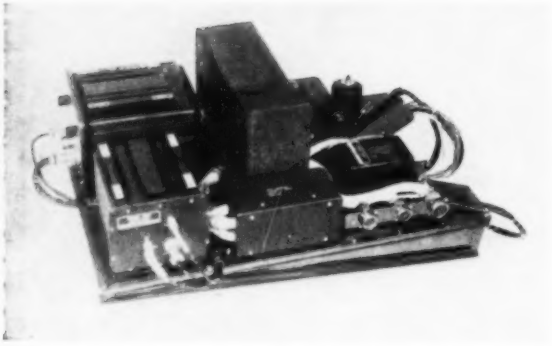
"On a recent Thursday," he said, "our travel agent tried to reserve one seat on a plane to Manchester for the following Monday; the first firm date that could be given was the following Thursday and even on that date the return journey had to be made by train as there was no plane reservation possible until the evening of that day.

"A trip to Glasgow has required two, three, or even more days' planning ahead, and it becomes virtually impossible to arrange a meeting in Glasgow and return to London the same day. We have even resorted to travelling to Edinburgh and thence by train to Glasgow."

The writer also complained about the difficulty of reaching the Corporation's busy reservations department by telephone—considering a delay of only half an hour as "lucky" and mentioning a recent occasion when his travel agent had been "unable to get a reply until the following day, having first had the 'engaged' signal at 3 o'clock on the previous afternoon."

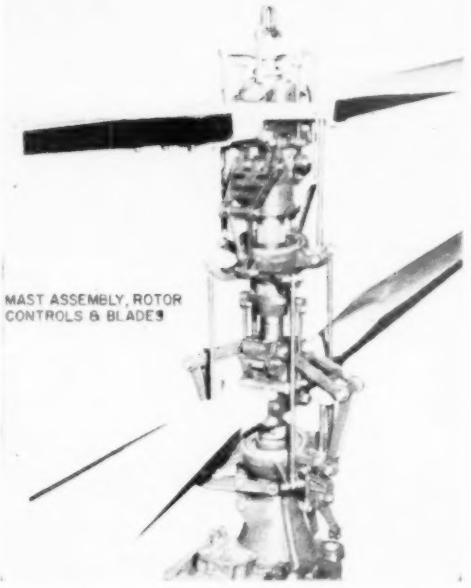
Rotary Automation

Howard Levy photographs



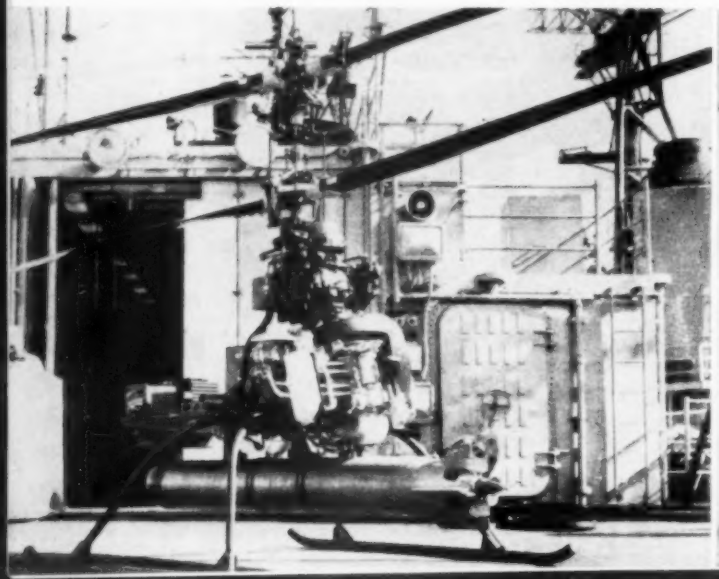
Above, the electronics assembly of " black boxes " for the DSN–1 remote control equipment; it is mounted just forward of the 72-b.h.p. Porsche engine.

Operational and evaluation tests aboard the U.S.S. " Hazelwood " have recently been made with the American Gyrodyne DSN–1 remote control helicopter equipped as a weapon carrier. Above, the craft over its landing platform at sea; right, details of the twin-rotor hub.



Below, a close-up of the Gyrodyne drone helicopter showing its underslung air-to-surface weapon—a homing torpedo, with which it constitutes the DASH (Destroyer Anti-Submarine Helicopter) weapons system.

Below, another shot of the Gyrodyne DSN–1 airborne without a pilot; nine of these craft have been built for evaluation.



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Aerospace in Europe

KENNETH GATLAND outlines the scope of the new West European industrial association of "Eurospace" which is expected to be inaugurated formally in Paris next week.

WITH the prospect of Western Europe joining Russia and the United States in the construction and launching of space-vehicles, it is natural that increasing attention should now be paid both by government and non-government agencies to the many technical, administrative and economic questions which participation in this new field involves. On the industrial side, a lead has been given by Hawker Siddeley in this country and the Société pour l'Etude et la Realisation d'Engins Ballistiques (S.E.R.E.B.) in France, who earlier this year published the results of a joint investigation into certain limited areas of space technology under the title of "Industry and Space." This study, which was issued on a purely private basis, had no connection with the discussions which have been taking place at governmental and scientific levels.

Although possible forms of co-operation between the two concerns were examined in some detail, it was recognized from the beginning that such an alliance could represent only the first phase in the evolution of a working European industrial partnership. It was with this view in mind that Hawker Siddeley and S.E.R.E.B. opened discussions with the representatives of other interested European companies in Paris on May 29, when the first steps were taken to establish a European Space Study Group under the heading of "Eurospace."

One of the leading architects of Eurospace, Mr. M. N. Golovine, M.B.E., speaking at a meeting of the European Symposium on Space Technology in London. He is managing director of Hawker Siddeley's A.T.S. Company.

Companies represented at this inaugural meeting were: Air Liquide; Boelkow-Entwicklungen; Bombrini-Parodi-Delfino; British Aircraft Corporation; British Space Development Company; Bristol Siddeley Engines; C.F.T.H.; C.S.F.; Daimler-Benz; Dornier-Werke; Fiat; Finmeccanica; Fokker; Heinkel G.m.b.H.; Hawker Siddeley Aviation; Hispano-Suiza; Junkers Flugzeug und Motorenwerke; MAN-Turbomotoren; Matra; M.B.L.E.; Messerschmitt; Nord-Aviation; SAAB; S.E.P.R.; Siemens-Halske; Sud-Aviation; Telefunken; Ugine; Weser-Flugzeugbau, and the German Association of Aircraft Manufacturers.

A provisional Organizing Committee was formed at this meeting under the chairmanship of M. Jean Delorme (president of Air Liquide). M. Delorme represents interests which normally would be outside the aircraft field and his company provides a good example of the widening interests which are being drawn together within the concept of the new association. M. Vinsonneau of S.E.R.E.B. was appointed Secretary General. There are 13 ordinary members.

When the General Assembly meets again in Paris on Sept. 21, this Organizing Committee will be superseded by a Council.

Aims and Objectives

The intention is to establish Eurospace as a non-profit-making association of West European industrial companies and, because of the wider ramifications of aerospace work, the scope of the organization will be much broader than that involved in the aircraft and allied industries.

Eurospace has three aims: First, to establish close technical and scientific liaison between members; second, to provide a central technical information service; and third, to provide a forum for discussion and the preparation of programmes and reports, etc., covering all aspects of aerospace co-operation.

It is important to emphasize that Eurospace is not intended to be a commercial association, binding the various companies together as a cartel. It may, however, work in conjunction with professional organizations without merging with them, preserving its autonomy and organizational structure. For instance, liaison has been established with the Association Internationale des Constructeurs de Matériel Aérospatial. Close contact would also be maintained with such bodies as the International Astronautical Federation, the Academy of Astronautics, and the various national astronautical societies.

Moreover, although the objects of the association will be to serve the interests of the West European industrial community, a special class of membership will allow participation by companies in the United States and elsewhere.

It is also necessary to stress that Eurospace will not be competitive to ESRO (European Space Research Organization) or any other organizations working on a government-to-government basis. By definition, government establishments will not be eligible for membership, but the association will be free to make recommendations on behalf of its members as opportunities arise.

One of the association's primary functions, for example, will be to provide for the formation of special study groups on an *ad hoc* basis (e.g., for the evaluation of projects of mutual interests, budgets, etc.). At a meeting of the Organizing Committee in Paris in July, four Working Groups were established; these were instructed to prepare synoptic reports under four broad headings for consideration at this month's meeting of the Eurospace General Assembly.

The four subjects under consideration are: (1) Industrial property and patents (Rapporteur: M. Lamberton of Brevatom); (2) Collection, collation and dissemination of information to members (Rapporteur: M. Janssens of S.E.R.E.B.); (3) Advanced projects to follow the ESLO programme (Rapporteur: Prof. Ruden of Heinkel); and (4) European budgets and overall programmes (Rapporteur: Mr. M. N. Golovine of the A.T.S. Company, Hawker Siddeley Aviation).

It is proposed to have several grades of membership. For instance, Full Members will comprise industrial companies in Western Europe interested in aerospace work; they will have full voting rights. The class of Associate Member will cater for non-European participation (e.g., aerospace concerns in the United States), but without full voting rights. Provision is also expected to be made for Corporate Members, bringing in such organizations as AICMA, and Honorary Members, individuals of distinction in the field of astronautics.

Speaking in Germany earlier this year,* Mr. M. N. Golovine, M.B.E., managing director of Hawker Siddeley's A.T.S. Company in London, put forward some pungent views of his own concerning the need for European collaboration on the widest scale. His principal arguments were as follows:—

"The building of vehicles is a technological and industrial job. In the final analysis the task of Industry is the production

* At the Konstanz European Space Symposium of the Deutsche Gesellschaft für Rakententechnik und Raumfahrt, May, 1961.

of hardware. This has always been so, and there is no apparent reason why there should be a departure from this basic principle in the case of aerospace work. Clearly there will be no mass production on the scale of military aircraft but, nevertheless, aerospace vehicles, particularly those which may have 'civil' applications, must be built on what could be described as a commercial basis.

"Experimental establishments have a very considerable part to play but they cannot take the place of Industry; this is an instance where close collaboration is a matter of the greatest importance.

"If Western Europe is to take up aerospace work in earnest and on an adequate scale, the problem must be treated as one requiring a very considerable amount of preliminary thought and study at the industrial level. It is difficult to visualize how a European programme, particularly with a commercial slant, can be implemented direct by governments without a co-ordination of European industries which, in the final analysis, would be responsible for the technological and engineering realization of the projects concerned.

"In the United States, aerospace constructors play a very important rôle; in fact, it has been reported that approximately 85% of NASA's budgets go to the industry. This is not surprising since the American aviation policy has always been that building programmes, including research and development, were regarded as the task of Industry."

Assuming that the West European space programme is finally established, Mr. Golovine said it was logical that the European industry should be the keystone of the whole enterprise. This would include not only aviation interests, but also companies concerned with materials, cryogenics, electronics and ground support equipment.

"Thus," he went on, "it is imperative that a complete review of all aerospace fields of activity should be made right at the beginning. This would include a number of items which may not have immediate or even near-future applications in Europe; but, nevertheless, it is important that the whole area of possible space activities should be properly surveyed before embarking on any kind of space programme.

"In the report prepared jointly by Hawker Siddeley Aviation and S.E.R.E.B.," Mr. Golovine continued, "it was recognized that co-operation on a wider scale is highly desirable, if not essential, if it is wished to carry out a programme which enables the European nations to maintain their political, military, scientific and technical positions.

"Fresh aspects would arise from any extension of the number of partners. In fact, certain countries may prefer to contribute to only part of the programme, in relation to the national objectives which they seek, their individual political situations and their economic and technical capabilities.

"It is, on the other hand, essential that the overall technological 'know-how' should be at the disposal of all the participants and that joint infrastructure be maintained.

"Co-operation should thus be organized on foundations which are both solid and flexible, so that the largest possible number of countries may take part in the whole undertaking, subject, of course, to each country selecting the specific programmes in which it is in a position to collaborate.

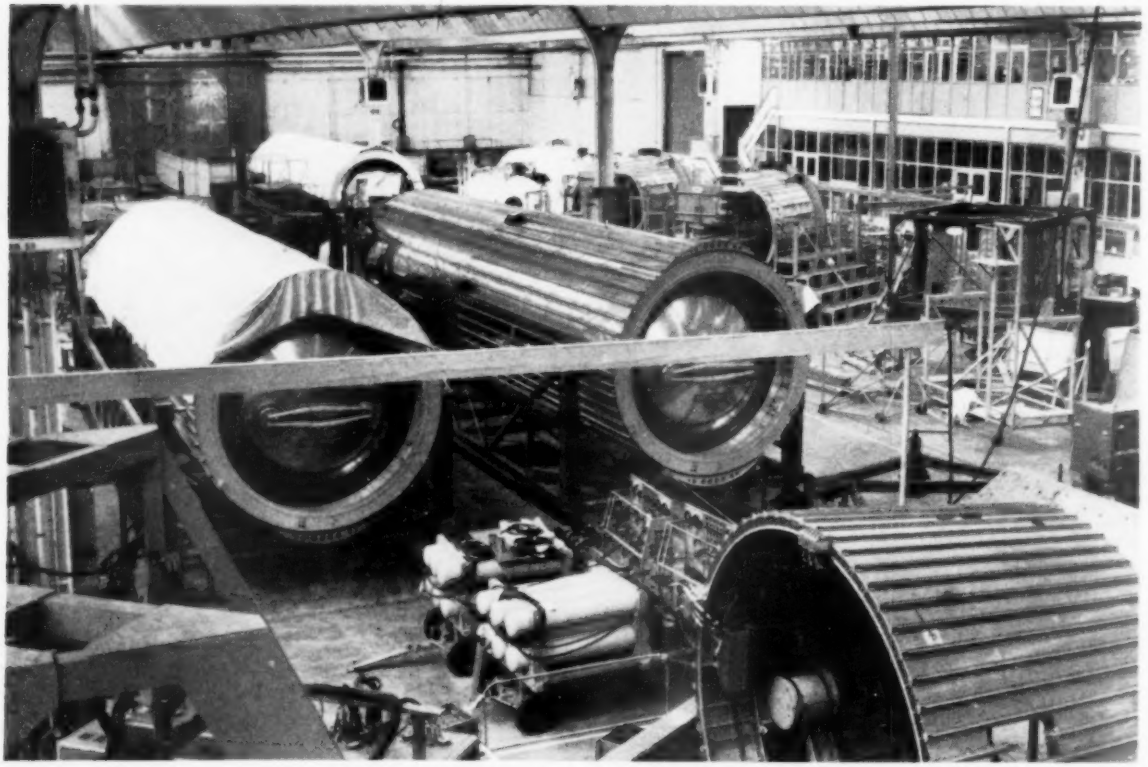
"The application of a number of sound principles should enable the apparently contradictory requirements for solidarity and flexibility to be reconciled. These are: (1) Sharing of joint costs, *pro rata* with participation in specific projects; (2) task-sharing in specific projects, *pro rata* with national contributions; and (3) sharing of work between scientists and industrialists according to their respective qualifications."

Ensuring Continuity

These principles are broadly the same as will be applied in Eurospace. The need to look forward beyond the proposed launching vehicle based on Blue Streak is evident if continuity of development is to be maintained and if the initial scientific programmes established by ESRO are to be expanded into other fields of more direct industrial concern.

While the use of existing hardware will permit valuable experience to be gained during the formulative stages of a space-programme, developments affecting the economic growth of astronautics are likely to result only from the continual exploitation of new techniques. Among problems to be examined by Eurospace are those concerning remunerative outlets for aerospace development in the civilian field, and—allied to this—the question of cheapening the cost of placing a given payload in orbit. It will also be possible for the association to take up study projects of defence interest.

Eurospace headquarters are at 8, rue Cognacq-Jay, Paris 7e.



Blue Streak components at the Stevenage factory of the de Havilland Aircraft Company. The utilization of Blue Streak as a booster is a good example of a practical beginning for an integrated West European space-programme.

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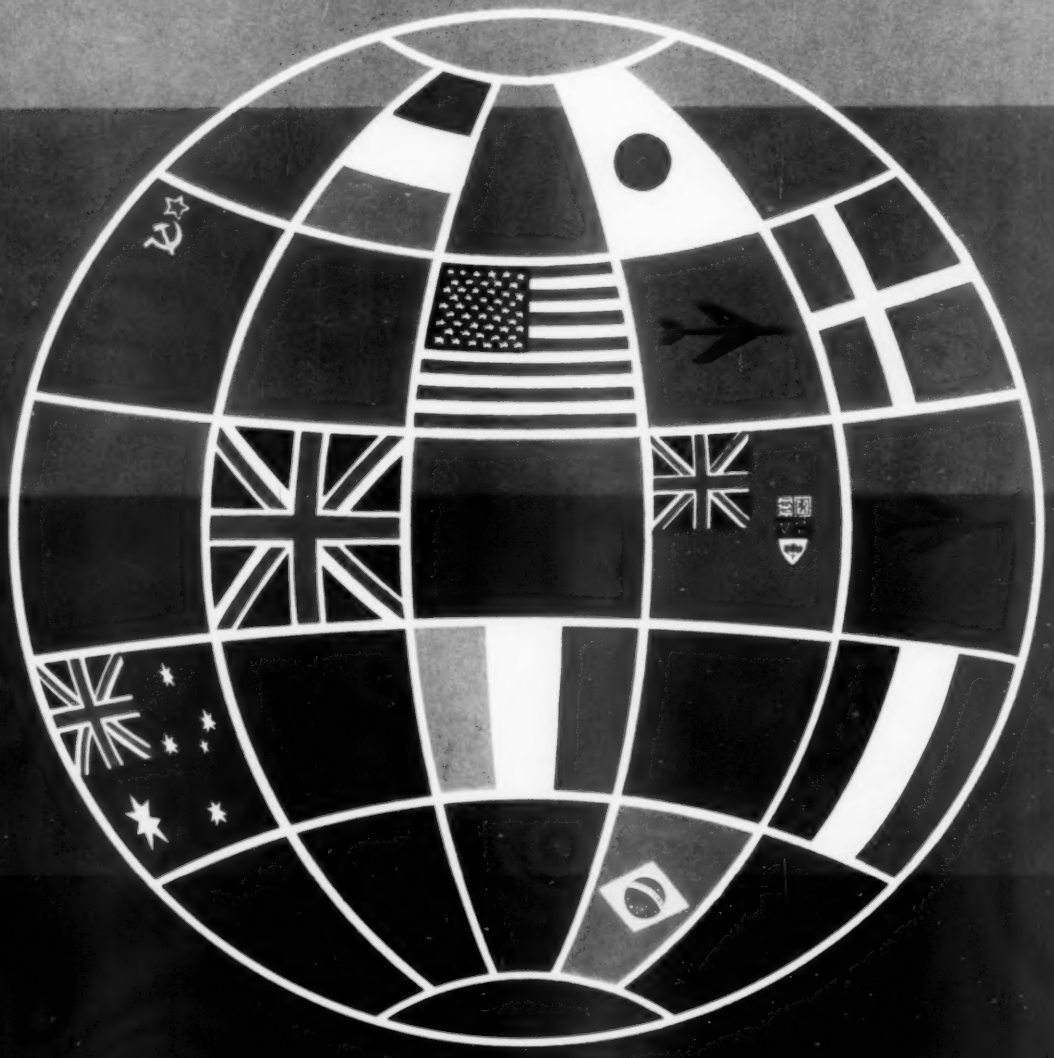

FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160 Mirage 3
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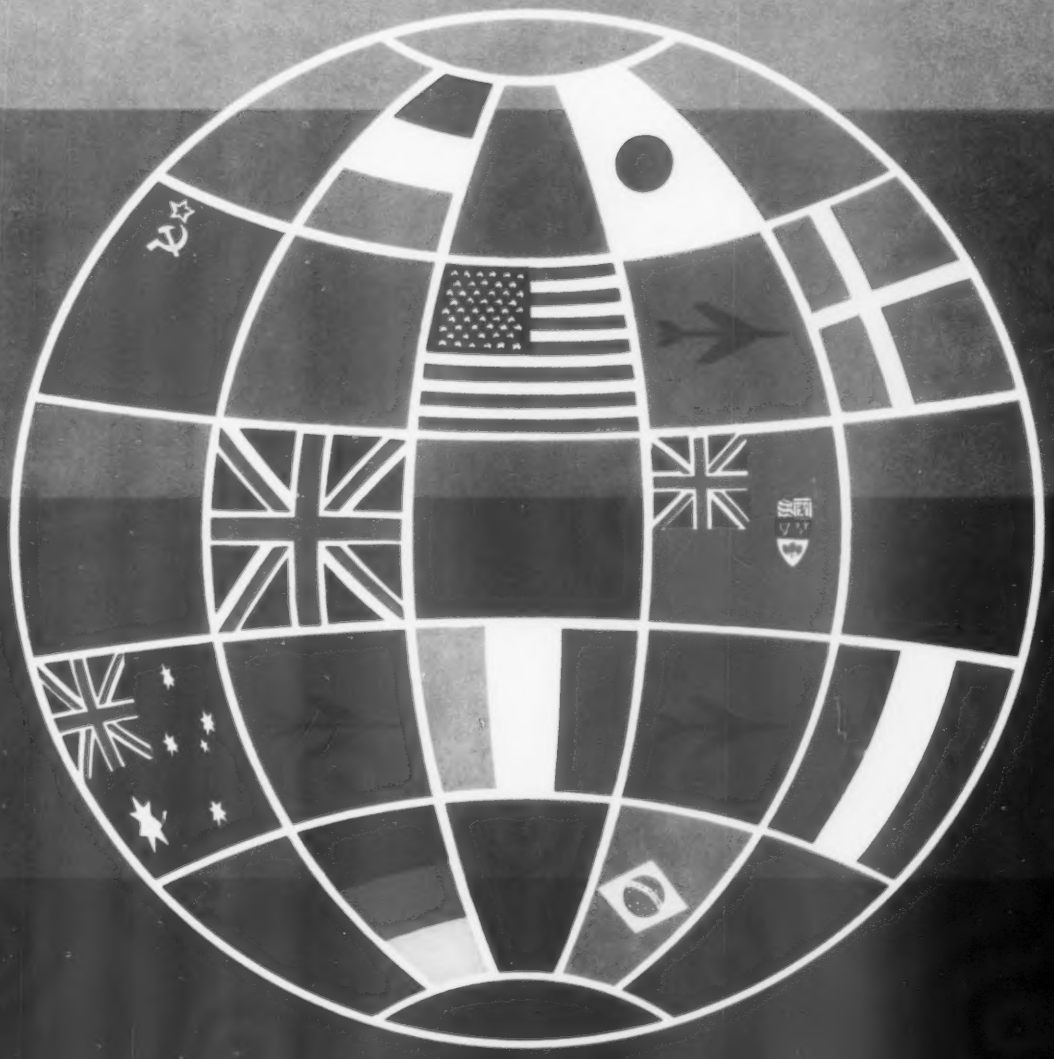

FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160
SWEDEN: SAAB Lansen SAAB Draken ITALY: Fiat G91T Macchi MB326
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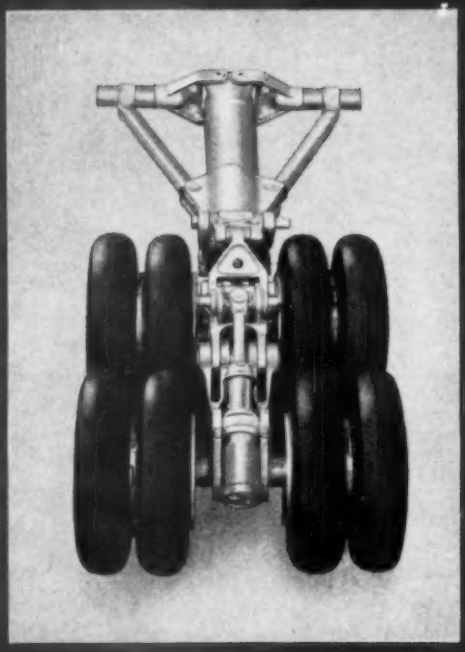

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The 1961 S.B.A.C. Show

Points from the Presidential Address

GUEST OF HONOUR AT THE S.B.A.C. BANQUET TO A THOUSAND *people at the Dorchester Hotel in London on Sept. 7 was the Rt. Hon. Reginald Maudling of the Board of Trade. Replying to the welcome by the Hon. H. G. Nelson, president of the S.B.A.C., Mr. Maudling paid tribute to the exporting success of the industry which could truly say that the World was its market. In his presidential address Mr. Nelson spoke warmly of the achievements in space of the Russians and Americans. Talking of his own industry, he said:—*

WE HAVE BEEN BUSY CONSOLIDATING OUR INDUSTRY INTO FEWER units, of greater resources. This has gone very well and there is no doubt that this concentration of resources in design, research, development, production and finance very much increases our industry's ability to develop and produce more quickly modern complex civil and military aircraft, engines and missiles.

IN THE MILITARY FIELD WE ARE GLAD TO SEE A SWING BACK OF the pendulum of opinion towards the manned aircraft and a more general recognition that there is a place in the future for manned aircraft alongside the rapidly developing guided missile in its many forms. In fact the marriage of the aircraft to the guided weapon is now a reality and all new military concepts are based on this very effective and powerful combination. The quality of our military aircraft is well known and in the guided missile field we have made great progress and our products stand up to comparisons with any in the World. In this new and rapidly developing field our industry has been outstandingly successful in obtaining some very important contracts on the basis of technical merit against stiff World competition.

IN THE CIVIL FIELD THE GROWTH OF THE TRANSPORT MARKET IS AT the present time faltering somewhat. Accurate forecasts of traffic growth have predicted a doubling of loads over seven-eight years. I am sure we can have confidence that these forecasts will, in fact, prove to be accurate, and the present disturbing falls in load factors will be a passing phase. We have every confidence therefore that our latest series of civil aircraft will find much favour with airlines during the next decade.

WE VERY MUCH WELCOME THE TALKS WHICH HAVE BEEN TAKING place on a European space programme and we are delighted that recently the Federal German Government has agreed to join with France and ourselves in creating an organization to develop satellite launchers.

THE SO-CALLED "INTERDEPENDENCE PROGRAMMES" HAVE NOT progressed very quickly, due I think to a reluctance on the part of many to accept that such schemes must grant to each party a major piece of work in the programme. We think that only when this is realized and accepted will such ideas, sound in theory, become a practical reality.

COMMENTING ON THE RECENT APPLICATION OF THIS COUNTRY TO join the Common Market, Mr. Nelson said that increasing size and performance have always been a feature of aviation development. Advantage accrues from increased size and performance of aircraft and engines, and also from increased size of markets and of technical and production teams and from increased size of Government purses. These are the factors which govern the economics of our industry, much more than comparative labour rates and tariff differentials.

THE BRITISH AIRCRAFT INDUSTRY IS ONE OF THE GREATEST OF OUR exporting industries. Last year our products once again found favour all over the World. During 1960 we exported £142m.-worth of aviation equipment, and 1961 figures are so far very satisfactory. We are very proud of this achievement which constitutes 11% of all U.K. engineering exports.

WE THINK THERE IS CONSIDERABLE SCOPE FOR GREATER co-operation on an international basis. First, the S.B.A.C. has been exploring with AICMA (International Association of Aero-space Industries) special ways and means of our industries working closer together. Secondly, we feel that the cost of some projects in the future will be so high that international co-operation between major groups of our country with those of another will be essential if unnecessary duplication and wasteful competition is to be avoided and if sufficient resources and a market of sufficient size is to be made available.

The Hon. H. G. Nelson (centre), president of the S.B.A.C., greets Earl Mountbatten of Burma on his arrival at the Show. Extreme right is Mr. E. C. Bowyer, director of the S.B.A.C., and extreme left, Mr. H. W. Goodinge, assistant director. Second from right is Rear Admiral R. V. Brockman.

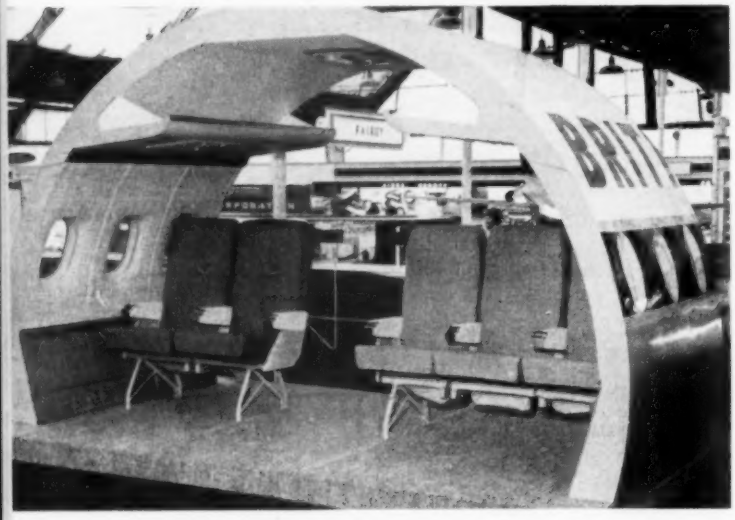
Second Show Report . . . .

Progress with the Prototypes

A summary of new information, gathered at the S.B.A.C. Display, about the newest British aircraft.

SIX of the 12 completely new aircraft now under construction in this country are B.A.C. projects—the One-Eleven short-range jet (to fly in the second quarter, 1963); the Vickers VC10 (to fly early 1962) and Super VC10 (to fly in the first quarter, 1964); the Bristol 188 (to fly next month); the TSR-2 (due to fly in 1963) and the Hunting H-126 jet flap research aircraft (first flight date not announced).

Since the B.A.C. board decision, taken last April, to proceed with the immediate production of 20 **One-Elevens**, a small project team has been established at Weybridge to co-ordinate the detailed engineering activities at Hurn (Vickers), Bournemouth (Bristol) and Luton (Hunting). The detailed specification for the One-Eleven has now been drawn up and most of the major design decisions on structure and systems have been made.



This display on the British Aircraft Corporation stand gave a good impression of the size of the One-Eleven cabin, with five-abreast seating and close-pitched windows.

A customer accommodation mock-up has been built at Weybridge for seating lay-out trials; the engineering mock-up is at Hurn, where final assembly and test-flying will take place, and a full-scale wing mock-up has been built at Luton. Five One-Elevens are to be allocated to the test programme, with the first due to fly in the second quarter of 1963 and certification in time for initial deliveries in the last quarter of 1964. Quantity production will be achieved early in 1965.

The test programme includes the use of one complete airframe for strength, pressure and fail-safe testing. Pressure fatigue testing of the fuselage will be for not less than 100,000 cycles before the fail-safe tests are made. Fatigue tests are to be made on the tailplane and landing gear mountings and the second and fourth sets of One-Eleven components have been allocated for test purposes.

Since this aircraft was first announced, the weights have varied somewhat, and the maximum take-off weight is now 73,500 lb. The earlier maximum weight of 68,250 lb. had been fixed at 5% above the designed landing weight (65,000 lb.) and was adequate for full-payload performance over ranges up to 750 naut. miles. B.A.C. salesmen have already encountered an airline demand for greater range, however, and the higher weight, originally regarded as optional, is now likely to be basic; it is achieved with virtually no modification beyond an increase in braking power.

A further range increase can be obtained by using centre-section tanks for 850 Imp. gallons of fuel. The weight penalty is 280 lb., and as the gross weight remains unchanged, range is then obtained at the expense of payload.

With the centre-section tanks, the total fuel capacity is 3,100 Imp. gallons, and the maximum range on this fuel (with two hours' holding) is more than 2,500 naut. miles. B.A.C. have suggested the One-Eleven as an executive aeroplane capable of carrying a typical 10-passenger executive load this distance in considerable comfort.

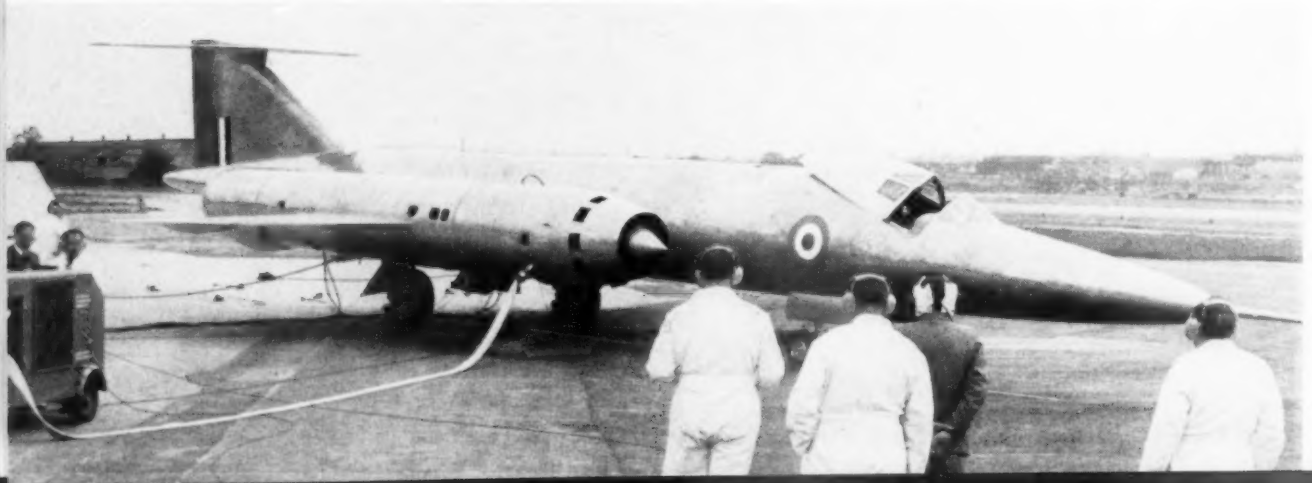
Work on the **BAC-107** project, from which the One-Eleven was evolved, is on a lower priority, being related in time to the availability of the 7,550-lb.s.t. Bristol Siddeley BS.75. With the same wing as the One-Eleven, the BAC-107 would be 36 in. shorter and would carry 8-10 fewer passengers. The gross weight, provisionally, is 56,500 lb. and the max. payload 12,000 lb.

Like the One-Eleven, the **Vickers VC10** has recently been growing in weight. Although those civil VC10s now on order —15 for B.O.A.C., four for B.U.A., three for Ghana—will be at the original weight of 299,000 lb., the basic model is on offer at 310,000 lb. The new and (in brackets) old landing weights are 206,000 lb. (199,000 lb.) and the zero fuel weights 184,000 lb. (178,000 lb.).

The effect of these increases is to move the top line of the payload-range curve up by 3,000 lb. to 38,000 lb., and to extend it by 200 naut. miles to 3,650 miles. They also allow the use of larger fuel reserves required for some long overwater

(*Continued on page 357*)

This new picture of the Bristol 188 was issued at Farnborough, and interesting exhibits on the B.A.C. stand showed some of the puddle-welding techniques used in the construction of this supersonic research aircraft. The first flight is now expected next month.



THERMIONIC

SIX CHANNEL

RECORDING EQUIPMENT

A rugged and simple to operate Six Channel Magnetic Tape Recorder for use on Airfields, Ports and Harbours, Electricity Grid Control Centres, Police Communications, etc.

The equipment is available in portable or rack mounted installations. An installation to suit individual requirements may be built up from the four basic units:

The tape transport deck, the record unit, the replay unit and bulk erase unit. The recorder may consist of a single tape deck or two tape decks with automatic changeover.

CUT ALONG DOTTED LINE

Cross Talk 40 db
Signal to noise ratio 40 db } 35 db.
Distortion: Better than 5%
Mains Supply either: 100/120 volts A.C. 50 cycles, or 200/250 volts A.C. 50 cycles. 60 cycles equipment available to order.

TECHNICAL DATA

Input Impedance: Approx. 30 Kohms allowing for a loading of less than 0·3 db when placed across a 600 ohm line.

Input level: Minus 12 db referred to 1 milliwatt.

Recording Medium: Polyester based "long play" tape ¼" wide.

Recording Tracks: Six on ¼" tape.

Tape Speed: 15/16" per second.

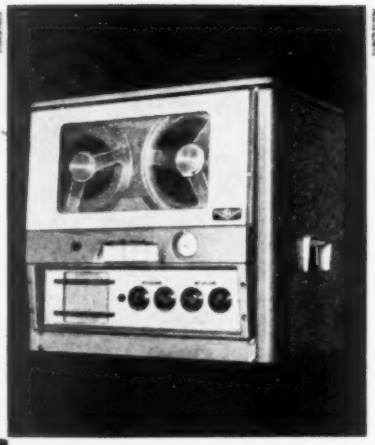
Frequency Response: 300-3,000 cycles per second ± 3 db.

THERMIONIC PRODUCTS (ELECTRONICS) LTD

HYTHE, SOUTHAMPTON · *Telephone: HYTHE 3265/7 · Cables: TECHNICO*

PLEASE TURN OVER

THERMIONIC SIX CHANNEL RECORDING EQUIPMENT



GENERAL

The equipment is built up of a number of self contained standard 19" panel mounted units, for mounting either in existing open racking or cabinets, or in a portable case.

Front panels are deeply flanged and provided with transparent covers. In order to maintain portability and to enhance reliability the equipment is fully transistorised. Printed circuitry is used where advantageous. All inter unit connections are via plugs and sockets to MIL, NATO and British Inter Service Specifications.

There are four basic units. Tape transport deck, record unit, replay unit and erase unit.

TAPE TRANSPORT DECK

A precision three motor tape transport incorporates full variable-speed spooling facilities and operates at a normal record or replay speed of $\frac{15}{16}$" per second. Six tracks are recorded in parallel on $\frac{1}{4}$" wide tape.

Interlaced three channel head blocks are used to provide the close spacing required. The heads are mounted on a precision machined mounting plate providing positive alignment under all conditions.

A tape driven, time calibrated tachometer is provided for rapid indexing and tracing of recorded material.

Simple interlocked push-button control provides ease of operation and protection against tape spill or breakage.

The brakes of efficient and simple design are solenoid operated.

Standard 8¼" reels of "long play" tape provide eight hours continuous recording time with overlap to cover automatic changeover where more than one tape deck is used.

RECORD UNIT

The unit comprises the main electronic recording facilities. Three printed circuit boards carry each two individual record amplifier circuits containing each: two signal transformers, windings cast in resin, varnish impregnated—four metal film ceramic encapsulated resistors and one transistor of proven reliability (maximum failure rate 0.03% per 1,000 hours).

In addition, using components to similar standards, two further circuits, bias oscillator and voice operated stop/start amplifier are provided. The components are mounted on a glass fibre based copper laminate printed circuit board.

On the front panel, metering facilities are provided as follows:

Bias level, record level and aural headphone monitoring (head current)—all via six position rotary channel selector switch.

An automatic voice operated stop/start is incorporated and an over-ride switch is provided for continuous recording.

Contacts are provided for remote operation of aural and visual alarms. There is a test point for the 18 volt D.C. line.

REPLAY UNIT

A printed circuit board carries two transistorised replay amplifier circuits of similar standards to those in the record unit, using low noise transistors, providing a signal noise ratio better than 40 db. Full compensation for tape frequency characteristics are incorporated.

The two amplifier circuits are separately switched and provided with individual gain controls. Outputs are provided to loudspeaker, headphones and 600 ohm line. Transcription facilities comprise typist's headset and foot pedal control incorporating run-back.

BULK ERASE UNIT

For security reasons no erase facility is provided on the equipment itself. The bulk erase unit is portable and provided with suitable locks.

TIME INJECTION

A Series III Time Injection Unit may be used with this equipment as an optional extra.

Designed to meet the requirements of the British General Post Office for connection to lines and switchboards.

Fully tropicalised throughout.

Dimensions

UNIT	Width	Height	Depth (Back to Front)	
Tape Deck	19 48·25	12¼ 31·20	7⅝ 29·60	ins. cms.
Record	19 48·25	5½ 13·35	10 25·50	ins. cms.
Replay	19 48·25	5½ 13·35	10 25·50	ins. cms.
Erase	5 48·25	4 10·20	6½ 16·50	ins. cms.
Time Injection	19 48·25	5½ 13·35	15 38·00	ins. cms.

THERMIONIC PRODUCTS (ELECTRONICS) LTD

HYTHE SOUTHAMPTON · Telephone: HYTHE 3265/7 · Cables: TECHNICO

PLEASE TURN OVER

CUT ALONG DOTTED LINE

Second Show Report . . . .

(*Continued from page 356*)

Three models on the Rolls-Royce stand showed possible applications of jet lift engines. This one is a tactical transport with underwing pods for thrust engines with exhaust deflectors, and banks of lift engines in wing nacelles.

routes. A stronger undercarriage is required for the higher landing weight, with a weight penalty of about 300 lb. Transport Command's five military VC10s are expected to be 310,000-lb. aeroplanes, and will have 21,825-lb.s.t. Conway RCo.42/3 engines to avoid compromising the take-off performance.

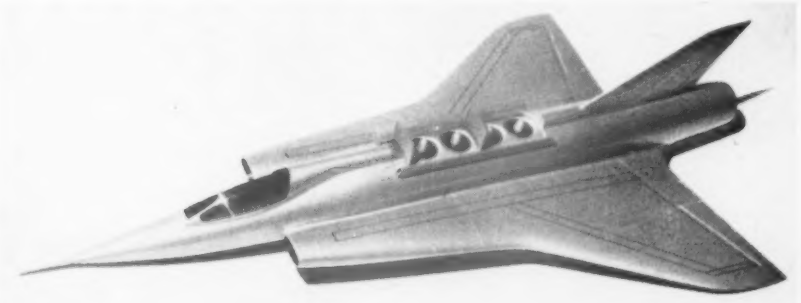
The **Super VC10,** after passing through a number of development stages, is now firmly pegged at 322,000 lb. with the fuselage 156 in. longer than that of the basic VC10. Of the increase, 75 in. is aft of the flight deck, and 81 in. aft of the wing trailing-edge.

The fact that this fuselage is not now so long as was at first proposed for the Super VC10 has allowed the Vickers design team to revert to the idea of a fuel tank in the fin, previously rejected because of trim and C.G. problems. This tank, with a 9,000-lb. capacity, is in the fin torsion box, and will be emptied first.

Other changes on the Super VC10 are the use of the Conway RCo.42/3 Mk. 550 engines with thrust reversers on all engines rather than on the outers only; repositioning of the forward passenger door farther aft and moving the rear passenger door from in front of the wing to behind it.

Recent highlights in the VC10 construction programme at Weybridge have been the initial cabin pressurization test at 9 p.s.i. (the normal full working pressure) and the removal of the first wing main structure from its jig. The fuselage and wing are to be assembled together this month. Testing of the Conway RCo.42/1 Mk. 540 is continuing meanwhile at Derby.

These Rolls-Royce models show, above, a swept wing strike aircraft with pairs of lift engines ahead of and behind the central weapon bay; and, right, a delta strike aircraft with a by-pass propulsion engine and four lift engines in line along the fuselage.



The first run was made in March this year and present work includes testing of the thrust-reverser system.

HAWKER SIDDELEY GROUP

Two of the 12 aircraft types due to fly in the next year or two are Hawker Siddeley projects—the D.H.121 Trident and the D.H.125. A third new type, the P.1127, is already in the air but was a regretted absentee from Farnborough. A few new facts became available during the week, however.

The first **Hawker P.1127,** which made its first free (untethered) hover on Nov. 19 last year, was joined by the second of the six prototypes on Jly. 5 last. They are almost identical, but a few differences occur, particularly in the control systems. One prototype is now being applied to the vertical phase of the transition trials and the other to the horizontal phase.

Closing this gap depends largely on engine power—i.e., having enough excess of power over weight to obtain sufficient lift with the jet nozzles deflected. The engine development programme, in which the U.S. Government is participating to the extent of 75% of the cost, is at present aimed at achieving this power and extending the engine life. About 80 hovers have been made to date.

The first **de Havilland D.H.125** (the name Jet Dragon is not now being used) is scheduled to fly next June, and will be powered initially by Bristol Siddeley Viper ASV.11s. Last week, de Havilland signed a £1 million contract with Bristol Siddeley for 60 Viper ASV.20s to power the first 30 D.H.125s, and it was announced at the same time that Bristol Siddeley

A new impression of the D.H.125, first orders for which were announced at the Show.

have ordered the first D.H.125. This will be delivered ahead of certification, for engine development flying, but is intended for use eventually in the executive rôle by Bristol Siddeley.

First run of the ASV.20 is scheduled before the end of this year, and these 3,000-lb.s.t. engines should be installed in the D.H.125 by this time next year.

Positive interest in the D.H.125 has been shown by prospective customers in at least 40 countries, and D.H. expect several dozen orders to be confirmed as soon as the contractual price has been finalized. Deliveries are to begin early in 1963.

Of the **D.H.121 Trident,** little new was being said at Farnborough. Since its roll-out two weeks ahead of schedule, the first production Trident has completed taxi trials with ground running engines, and the first flight should be made before the end of this year. Latest data show a 2,000-lb. increase in the max. take-off and landing weights—to 107,000 lb. and 102,000 lb. respectively.

It has become an Avro tradition that a new aeroplane is flown in late August or early September, for exhibition at Farnborough. This year, the aircraft was the first production

Second Show Report . . . .

Avro 748, G-ARMV, flown on Aug. 30. Furnished as a 44-seater, it is the first of three for Skyways and is equipped to customer specification, with Collins radio aerials prominent on the fuselage. Route proving trials are to be undertaken by Skyways in the near future on the cross-Channel routes to Beauvais, Lyons, Vichy and Montpelier; if these go well, the C. of A. should be obtained by the end of October.

Tropical trials were completed recently by the second prototype, G-ARAY, as a result of which certification is expected at 36,800 lb. for temperatures up to I.S.A. +30° C. and elevations up to 5,000 ft. This weight is higher than originally specified, and the payload has also been increased, by 600 lb. to 10,586 lb., in the light of the structural and fatigue testing.

The 748 Series 2, with the Dart R.Da.7 engines, will likewise benefit from weight growth of a similar order. The certificated weight is expected to rise quickly to 40,000 lb., compared with the 38,000 lb. quoted to date, and a weight

of 42,000 lb. with a 13,000-lb. payload appears to be well within the bounds of possibility with some structural strengthening. The second prototype 748 is soon to be converted to Series 2 standard, and the first production Series 2 is to fly next spring.

To make the most of this weight growth in terms of payload, the **Avro 748E** has been announced with additional 3-ft. fuselage sections both fore and aft of the centre-section. This would have the RDa.7 Darts; a version with 2,400 e.h.p. RDa.10s known as the Super E is further away, and might perhaps be overtaken by the small jet-engined feeder-liners.

Among Avro's ideas for a short-haul jet aeroplane is a version of the 748 with aft-mounted turbofan engines. Much of the existing structure could be used, with the wing "cropped" for higher speeds and the fuselage pulled out at least to the length of the 748E. The thought is that such an aeroplane, known as the **Avro 778,** at about 50,000 lb. with two 7,000 lb.s.t. Bristol Siddeley BS-75 or similar fan engines, could be offered sooner and more cheaply than a completely new design to do the same job.

HANDLEY PAGE, LTD.

In the field of laminar flow, this company has amassed a wealth of data and the Farnborough exhibit again showed convincingly the advantages of suction-slot laminarization for both subsonic and supersonic flight. Among the current projects, mention can be made of the **H.P.119,** an all-wing laminar research aircraft which is, in effect, a one-third scale model of the 300-seat transatlantic **H.P.117,** announced last year. Another model showed the Mach 2, laminarized **H.P.109** slender delta.

A more immediate project is the **military Herald,** which is being offered to meet the Army's need for a tactical short-field transport. Some very successful tests were made recently by one of the civil Heralds landing and taking-off from a singularly unpleasant strip of loose, sandy soil at Martlesham.

The developed military Herald, as noted in our previous issue, would have a gross weight of 46,000 lb. and more powerful Darts—RDa.10 Mk. 542/10s at 2,775 s.h.p. plus 740 lb.s.t. Apart from the change of engine, some strengthening of the structure and a strengthened floor, the only major change would be to the rear fuselage, which would be untapered in plan view and would incorporate Caribou-type rear doors, suitable for direct loading and air dropping of supplies. The fin area would be increased by 12%.

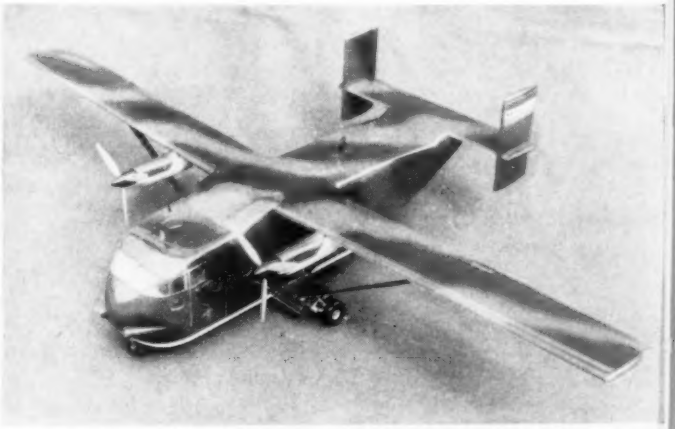
The military Herald would be dimensionally similar to the civil Series 200, providing a width at floor level of 6 ft. 8 in. and a length of 42 ft. including the space over the rear ramp. The floor would incorporate roller tracks at 30-in. pitch, primarily for the handling of standard pallets, and would have an overall strength sufficient for 200 lb./sq. ft. distributed loads. Outer wheel tracks would carry axle loadings of 5,250 lb. Provision is made for pressurizing the fuselage, but this naturally precludes the rear doors being opened in flight.

The maximum gross payload is 13,400 lb. and other weights are: max. landing, 41,000 lb.; max. zero fuel, 39,300 lb. and max. take-off and landing for close support duties, 37,000 lb. Using STOL techniques, the military Herald can take-off in 1,500 ft. in I.S.A. +20° C. from very soft soil with an 8,600 lb. payload and enough fuel for a 165 naut. mile operational radius. Standard fuel is 1,080 Imp. gallons; this can be supplemented by 1,200 Imp. gallons in underwing tanks for ferry ranges of more than 1,200 naut. miles with 20% reserves.

News of the commercial Herald last week included the order for two, plus an option, from Itavia, and a repeat order for one Series 200 from Maritime Central Airways, in whose colours the prototype appeared at Farnborough. This aircraft has been re-registered G-ARTC since its conversion to a Series 200 earlier this year; it is the original second prototype, G-AODF, which began life with Leonides engines and later had Darts fitted.

The C. of A. for the long-fuselage **Herald 200** was obtained last week, exactly a year after this development was first announced. The certificated weight is 40,000 lb., but a stronger undercarriage will be introduced on the 22nd aircraft *et seq* to allow the weight to increase to 43,000 lb. Subsequently, operators of the original Heralds will have the opportunity to have their aircraft converted.

The principal effect of this weight increase will be to allow bigger payloads to be carried over equivalent ranges. This is demonstrated by two examples quoted by the makers. On the 726-naut.-mile London-Palma sector, with realistic reserves (alternate, Barcelona), the 40,000-lb. Herald will take a payload of 8,276 lb. at a block speed of 200 knots. At 43,000 lb., the payload goes up to 10,761 lb. and the block speed decreases by 3 knots. On the 874-naut.-mile Cairo-Khartoum sector (I.S.A. +18° C., alternate Shendi), the comparative payloads would be 7,306 lb. and 9,876 lb., and the block speeds 201 knots and 200 knots respectively.



Comparative views of the Short Skyvan I (above left) and Skyvan II (above), dimensionally similar but respectively powered by piston and turboprop engines.

SHORT BROS. AND HARLAND

Two new aeroplanes are at present in hand at Queen's Island—the mighty Belfast (to fly before the end of 1962) and the comparatively diminutive Skyvan (to fly next spring).

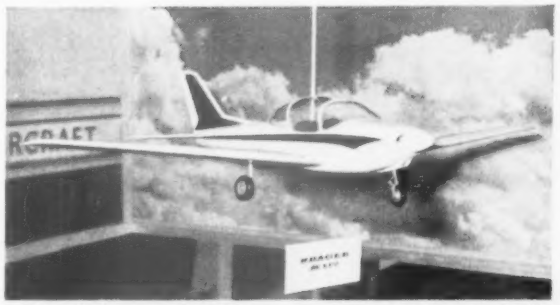
The private venture **Skyvan** is arousing encouraging interest in many parts of the World, and military and civil operators—in Australia, the U.S., East Africa, New Zealand and Ceylon, among other countries—have indicated a firm intention to buy. While the Continental-engined 9,300-lb. Skyvan I is by no means superceded, the Astazou-engined Skyvan II at 11,500 lb. is at least equally promising.

Preliminary data for the Skyvan II, which is described as a military proposal in the first instance and might well suit the Army's need for a tactical transport, show that it will carry a 4,500-lb. payload compared with the Skyvan I's 3,000 lb. The range with this payload varies from 300 naut. miles at 180 knots (maximum continuous rating) to 370 naut. miles at 140 knots; 4,000 lb. can be carried for 600 naut. miles at 140

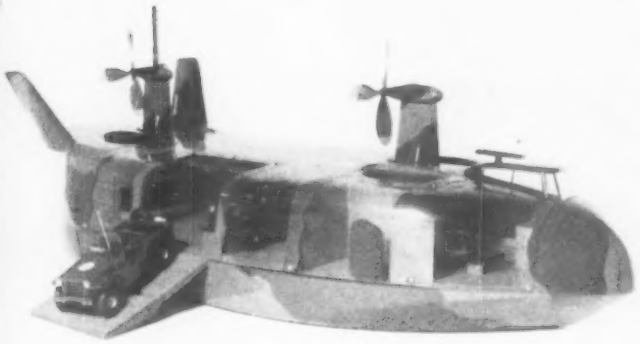
knots. Examples of the load which the Skyvan II can carry are: 14 paratroops, 4,000 lb. of paratroop supplies or 12 stretchers.

The Astazou engines, which may be built by Blackburn under licence from Turboméca, would be in SFERMA-designed powerplants to take advantage of the French company's now considerable experience with this 600-e.h.p. engine. Take-off performance of the Skyvan II includes a minimum ground run of 565 ft. in I.S.A. at sea level, when the distance to 50 ft. is 1,490 ft.; or a minimum distance to 50 ft. of 1,365 ft.

Additional information was given by Short Bros. on the SC.5/31 version of the **Belfast,** the swing-nosed proposal for civil use. Taking advantage of Stage 5 of Rolls-Royce Tyne development, this version has a gross weight of 294,000 lb.



One of the two Beagle-Miles types expected at the 1962 S.B.A.C. display, the M.117 is a two-seater with a Rolls-Royce Continental engine.



The Westland SRN-3 hovercraft is a projected development of the Nimbus-engined SRN-2, now under construction with possible military applications.

and a payload of 100,000 lb., compared with 220,500 lb. and 81,000 lb. respectively, for the R.A.F.'s SC.5/10. As a pure freighter, this Belfast may be somewhat ahead of airline requirements, but the mixed passenger/freight version, able to carry 141 passengers and 60,000 lb. of freight, is the kind of aeroplane which is attracting increasing airline interest. Such a version, the makers claim, could make a single fare of £30 possible across the North Atlantic.

The SC.5/31 would be fully "palletized" with a light floor forming the lower deck, with four built-in rollerways and channels for freight pallets. The upper deck is carried by two 3-ft.-wide ledges which each have roller-fitted longitudinal channels into which pallets, freight cages or a passenger floor can be slid to form the second deck.

This version of the Belfast has a considerably superior payload/range performance compared with that of the military SC.5/10 and the SC.5/20 project, the latter being a heavy tactical freighter with the emphasis on airfield performance. The R.A.F. Belfasts will carry their 81,000-lb. payload a distance of only 1,000 st. miles, and provision is consequently being made for flight refuelling. The probe will be above the cockpit roof, with twin pipes running back, externally, to the wing/fuselage fairing, and then joining the main refuelling galleries.

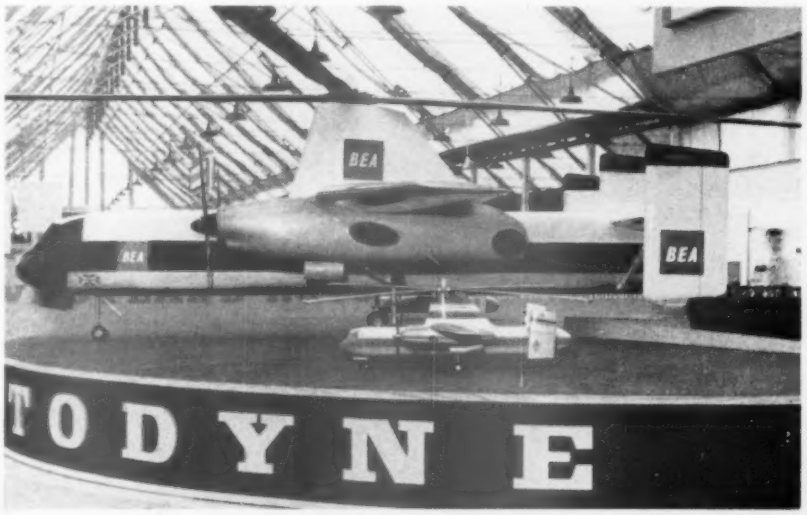
WESTLAND AIRCRAFT, LTD.

Although the **Rotodyne** was prominently displayed on the Westland stand in B.E.A., B.U.A. and R.A.F. colours, little new could be said in the absence of a Government decision to support production of the Tyne-engined version. The development contract does not at present cover construction of a prototype of the larger machine, but the basic design has now been settled, and research is continuing on a number of problems—not least, that of noise from the tip-jets. The gross weight of the military Tyne-engined version has now grown to 60,000 lb., with accommodation for 73 equipped troops or 40 stretchers.

More positive news was given at Farnborough of the **Wessex HC.2,** which has now been ordered in "substantial" numbers by the Royal Air Force. The Wessex 2 differs from the Navy's HAS.1 in having the de Havilland Coupled Gnome engine, and consequently engine-out reliability. The R.A.F. has specified the Wessex 2 for transport, freight, ambulance and general duties, and the additional power of the new engine will be of particular value in high altitudes and high temperatures. Other variants, similarly powered, are being developed for the R.N.'s Commando requirements.

The Wessex 2 prototype is to fly before the end of the year, with Coupled Gnome H.1000s, but these are only temporary, and the coupled H.1200 will be installed later. Each H.1200 has a one-hour rating of 1,250 s.h.p., but the total power in the Wessex 2 is limited, by the transmission system, to 1,550 s.h.p., leaving an ample reserve for "hot and high" operations.

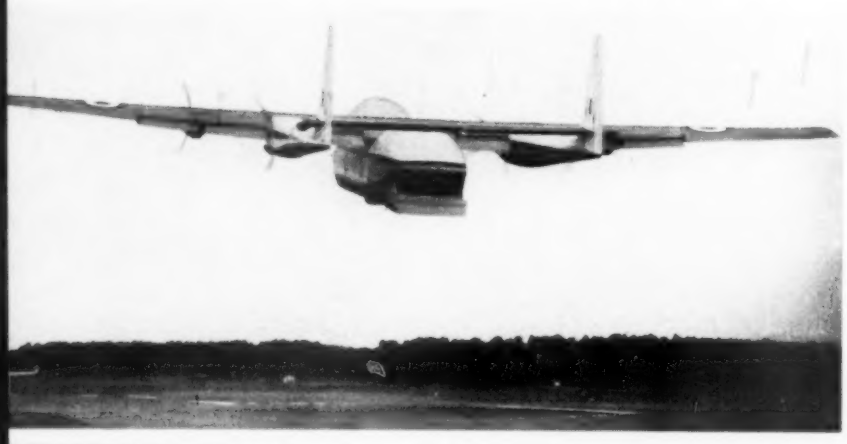
For single-engined operation, the Gnome has a 2½-min. maximum contingency rating of 1,350 s.h.p. which would be sufficient, in the event of engine failure, for a controlled emergency landing, or to gain sufficient forward speed for the flight to continue at a lower power setting.—F.G.S.



Accompanied by a small model in B.U.A. colours, this large model of the developed Rotodyne showed several design changes, such as the strut-braced tailplane, forward retracting undercarriage and twin exhausts from the Tyne nacelle. The latter could indicate the use of separate air compressors to feed the rotor-tip pressure jets.

FARNBOROUGH FLYING—

—*Some unusual display shots*

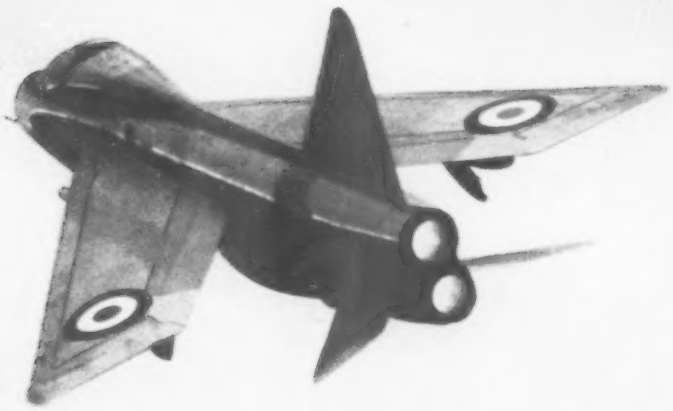


Above, No. 92 Squadron's Hunters are performing their bad-weather low-level "bomb-burst." Left, this rear view of the military Argosy shows to advantage its capacious clam-shell doors.

Below, the high humidity at the beginning of the week giving the Hunter Trainer a vapour hat during one of its high-speed runs past the enclosures.

Photographs copyright "The Aeroplane and Astronautics"

Below, the Westland Belved



Left, an outstanding display by Roland Beamont with the two-seat Lightning—seen here with its reheat burning brightly—included some spectacular high-*g* low-radius turns.

Below, No. 74 Squadron's Lightnings taking off and climbing vertically before forming up for their superb nine-aircraft formation aerobatics.

Below, the Royal Navy's Scimitars travelling fast—complete with smoke trails and humidity humps.

re remains poised while its Army passengers drop in to demonstrate a tactical assault on the Farnborough runway.

Second Show Report . . . .

More Engines on Show this Year

A powerplant specialist reviews the trends in turbine and rocket design as well as developments in the accessory field.

DESPITE the groupings and associations of the engine manufacturers—as evidenced by de Havilland and Blackburn on the Hawker Siddeley stand and the adjacency of Napier's stand to that of Rolls-Royce—there were probably more types of engines on display than for some years past. Some 40 different power units, with new rocket motors and piston engines in the fore, were on show. Although no new VTOL engines were displayed, these none the less undoubtedly formed the main propulsion theme at the Show, as they did in 1960.

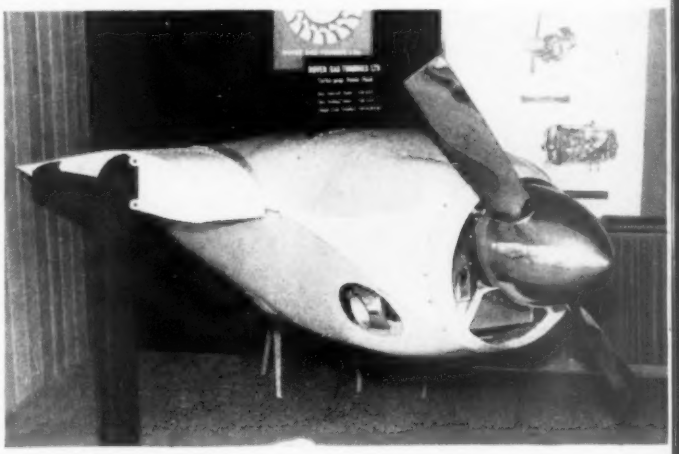
The VTO picture, instead of crystallizing along specific lines, in fact remains fluid. Bristol Siddeley and Rolls-Royce approaches to the requirements of VTOL propulsion continue to proceed together and there were even signs that each agrees there is a place for the other—Rolls-Royce exhibited a deflector nozzle for the first time which performs in a similar rôle to the swivelling nozzles on the Pegasus, and Bristol Siddeley made reference to small fan-lift engine projects.

Cogent reasons were listed by Bristol Siddeley for their advocacy of the single lift/thrust engine. Among the points made were that it provides a conventional installation with forward-facing intakes; that normal ground running and taxi-ing can be performed with the swivel nozzles horizontal; that ground erosion and reingestion problems are minimized by having the nozzles so pointed until the moment of vertical take-off; and that it is possible to take-off vertically, or after a short run, or with a full length run—in which case a heavy overload is possible.

The absence of the Hawker P.1127 from the Show—among other reasons as a consequence of the very tight development programme with the aircraft—was provided for by a particularly effective demonstration model which "flies" through a slant and vertical take-off, to a vertical and normal landing sequence. Swivelling engine nozzles on the model were provided with air jets, and streamers indicated the exhaust flow, and hence thrust angle, at each phase.

Rolls-Royce VTO models were also a centre of attraction—emphasis was given to the military tactical rôle and models illustrated how the composite engine system might be employed in a strike aircraft and in transports. With a cranked delta plan form, an essentially conventional strike aircraft having a turbofan engine for forward propulsion featured four small vertically mounted jet-lift engines installed in the fuselage. A more radical system was depicted in a second strike aircraft where two turbofans for main propulsion are fitted with deflector nozzles; these deflect the entire engine exhaust downwards, and the additional thrust required to give VTO performance is provided by a pair of jet-lift engines disposed fore and aft of the turbofans.

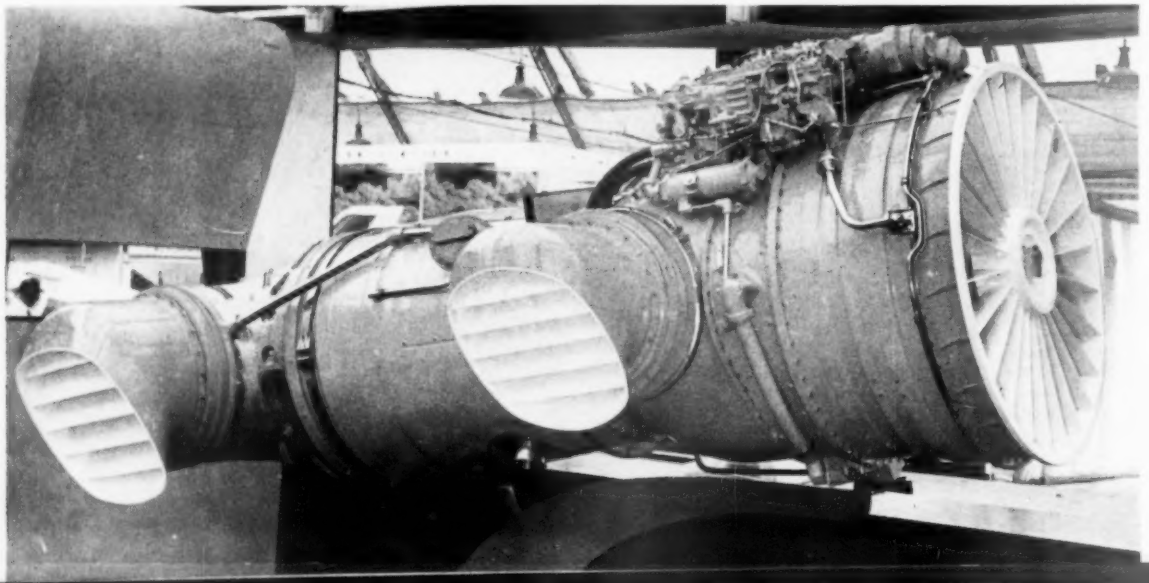
With this arrangement, the deflector nozzle cascades are capable of rotation to vector the thrust progressively from vertically downwards to rearwards during the process period of transition. A valve across the jet pipe then moves to blank-off the cascades and permit the exhaust to flow directly rearwards in the conventional manner. Essentially this provides a means of utilizing to the full the thrust of the forward progression engines before proceeding to incorporate jet-lift engines to provide the remaining thrust required to give VTOL capabilities.



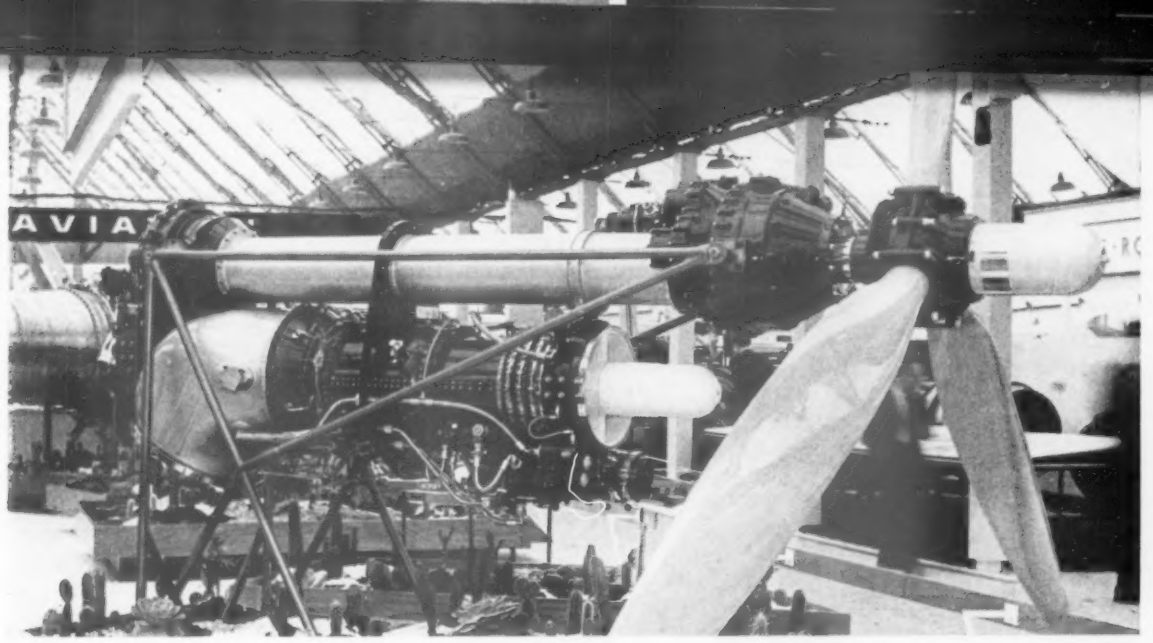
With a maximum cruise power of 100 b.h.p. (not 90 as quoted in our previous issue) the little Rover TP90 turboprop makes a very neat installation.

The transport model also featured deflector nozzles for its four main engines, and had batteries of jet-lift engines contained in single large pods mounted outboard on the wing. An alternative pod was displayed, having fan-lift engines for duties where noise restrictions are imposed.

Both Bristol Siddeley and Rolls-Royce hinted at additional applications for their engines. In the case of the former, this



Although not new to the Show, Bristol Siddeley's Pegasus lift/thrust powerplant for VTOL application and the Hawker P.1127 attracted a good deal of attention.



On the de Havilland Engine section of the Hawker Siddeley stand was this show example of the H1000 turboprop version of the Gnome.

was done by illustrations of transonic and supersonic strike aircraft and multi-engine transports, and in the latter by a more emphatic statement than hitherto which indicated that Rolls-Royce jet-lift and main propulsion engines are specified for new military V/STOL aircraft.

Likewise, both manufacturers drew attention to the European associations of their VTOL work—the Pegasus is being developed with United States Government assistance with a view to meeting the NATO requirements for strike fighters and transports having V/STOL characteristics, and Rolls-Royce referred to joint development of their latest jet-lift engine, the RB.162, with France and Germany. With entry into the Common Market looming ahead for Britain this is an aspect of some importance to both companies, and the use of the Bristol Siddeley Orpheus in the Fiat G.91 NATO lightweight fighter and the Hercules in the transport aircraft of the French and German Air Forces are both listed. Rolls-Royce referred to the licensed production of five of their turbine engines by France, Germany, Sweden and Belgium.

Other Rolls-Royce VTO exhibits were the RB.145 jet-lift engine, which first ran earlier this year, and was being shown with reheat and a variable area nozzle, and two RB.108 jet-lift engines installed in a dummy fuselage to illustrate a typical installation. A retractable cascade grille for deflecting the air into the engines during transition and folding doors to enclose the VTO bay were fitted. The very considerable background experience Rolls-Royce has in the VTO field was exemplified by photographs showing how the "bogeys" of reingestion and ground erosion are virtually non-existent.

Rocket propulsion developments were highlighted by the exhibition for the first time of the Rolls-Royce RZ.2, the Bristol Siddeley PR.37 and Gamma Mk. 301, and the de Havilland Spartan, all of liquid propellent design. Significantly, the largest motor ever to be exhibited in Britain, the RZ.2 is the power unit of Blue Streak; two motors forming the RZ.12 provide the launcher vehicle with a combined thrust of 274,000 lb. Development is under way to raise this to 300,000 lb. (details of the engine appeared in THE AEROPLANE AND ASTRONAUTICS of Aug. 3, 1961). A ¼-scale model demonstrating the installation of the RZ.12 in the propulsion bay was shown on the Rolls-Royce stand.

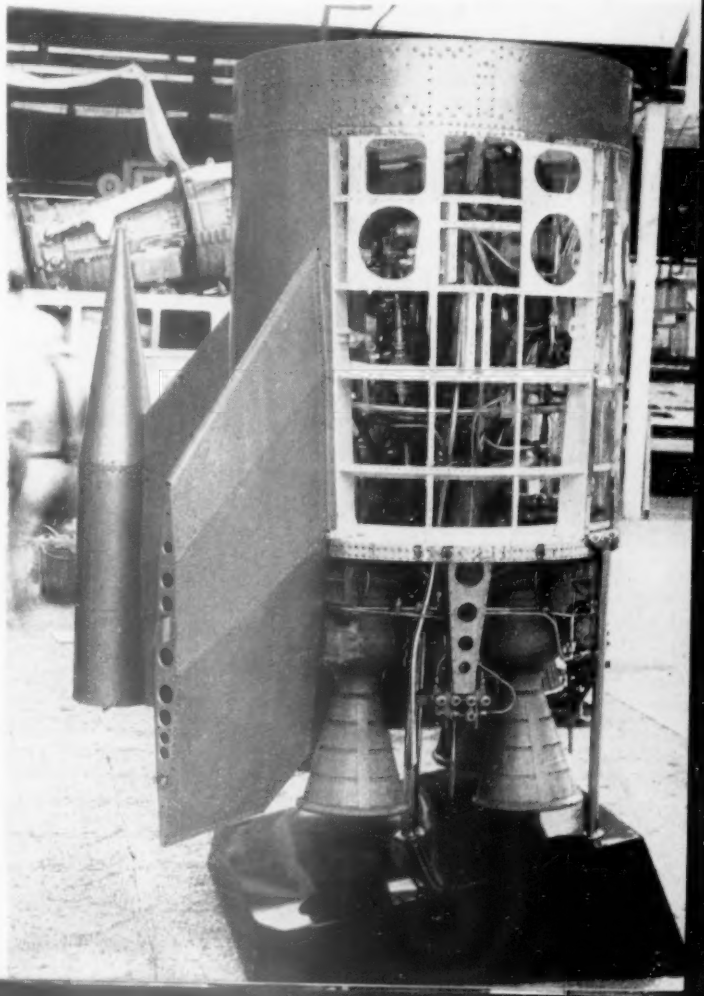
At the other extreme of the performance range, the interesting new Bristol Siddeley PR.37 produces 170 lb. thrust and is one of the smallest rocket engines ever to be made for a practical application. It operates on a kerosene/hydrogen-peroxide propellent combination and is under development as a boost unit for the Australian Jindivik target drone. The installation of the PR.37 will enable the Jindivik to achieve an operating ceiling in excess of 65,000 ft.

A later version of the Gamma, the Mk. 301, was being exhibited and incorporates improvements in the thrust chambers based on experience with the Mk. 201. The Gamma powers the Black Knight re-entry research vehicle which has been successful in all its 11 launchings to date.

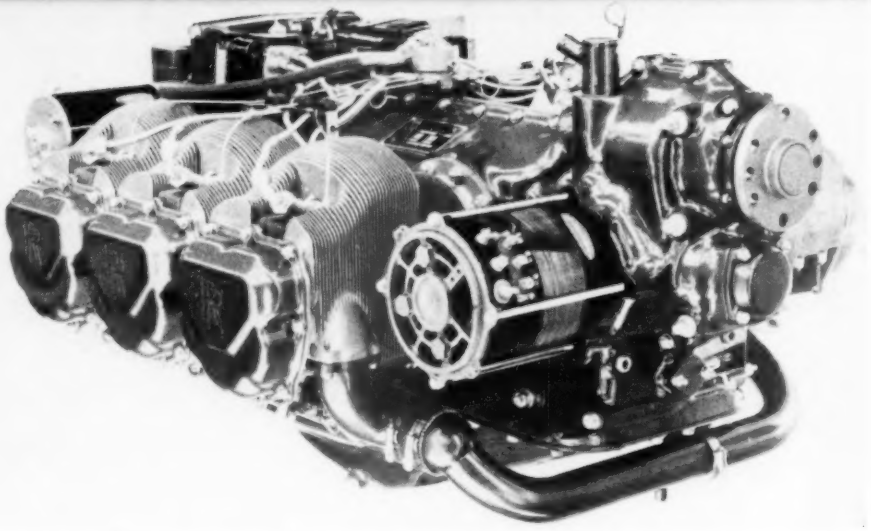
An entirely new development is the de Havilland Engine company's Spartan pre-packaged rocket, based on their technical agreement with the Thiokol Corporation of America. Basically of fixed-thrust design, pre-packaged motors provide an ingenious means for overcoming the traditional limitations of conventional liquid- and solid-propellent motors—in particular the mechanical complexity of the former and the performance inflexibility of the latter.

The Spartan comprises essentially a cylinder divided internally into two compartments containing the individual propellents, and axially in series with this a simple combustion chamber and expansion nozzle. A central tube with "burst-bands" provides the means for mixing and feeding the propellents to the combustion chamber. A pressure cartridge fires the motor by rupturing the burst-bands and ignition is provided by injection of a hypergol at the head of the combustion zone.

A number of advantages follow from this configuration—robust construction, lack of any need for specialized handling equipment, a high resistance to battle damage, and an external casing which may become an integral structural part of the missile it powers. In America, Thiokol pre-packaged motors



The latest version of the Bristol Siddeley Gamma rocket powerplant for the Black Knight re-entry research vehicle.



Seen in public for the first time in this country—and so far not shown in America—was this 310 b.h.p. Continental GIO-470-A to be built by Rolls-Royce as one of their new Continental range.

propel Bullpup air-to-ground and Sparrow air-to-air missiles.

New civil engines appearing for the first time included the Rolls-Royce Conway RCo.42/1 turbofan of 20,570 lb. minimum rating at take-off, for the Vickers VC10—as recorded elsewhere, an order for five of these aircraft was announced during the week for R.A.F. Transport Command. These will, in fact, be powered by the higher-rated RCo.42/3, of 21,825-lb. thrust, hitherto specified only for the Super VC10. The RCo.42 is essentially the H.P. rotor and hot-end components of the well-proven RCo.12 but with a higher mass-flow L.P. compressor giving a by-pass ratio of 0.6 : 1, twice that of the RCo.12.

A second new civil engine was the Bristol Siddeley Viper 20 of 3,000-lb. thrust rating and specified for the de Havilland 125 executive aircraft and the Piaggio-Douglas six-seat utility aircraft. The Viper 20 is developed from the Viper 11, involving the addition of a zero stage to the front of the compressor raising the mass flow from 44 to 52.8 lb./sec. and lowering the specific fuel consumption to 0.985 lb./hr./lb.

Scheduled to run for the first time in January, 1962, is the Bristol Siddeley BS.75 of 7,550-lb. thrust. Rig tests of several new components for this high by-pass ratio turbofan are already complete and the development programme is fully launched. Bristol Siddeley stated that the BS.75 has been chosen to power the B.A.C. short-range civil transport and that a military version is projected for combat and transport operations.

Rolls-Royce's somewhat larger counterpart to the BS.75—the Spey RB.163/1—was also exhibited. Two further applications for this turbofan have been announced since it was first exhibited last year. These are the B.A.C. One-Eleven short-range transport and the Blackburn Buccaneer S.2 strike aircraft.

Other new civil engines on show were the Rolls-Royce Continental light piston engines, in particular the 100-b.h.p. O-200-A, the 145-b.h.p. O-300-C and the 310-b.h.p. GIO-470-A, representing the first engines in the series to be manufactured by Rolls-Royce. The last-mentioned Continental will power production versions of the Beagle B.206, and was being exhibited for the first time ever in Britain or America.

A wide selection of helicopter engines in one display included the Napier Gazelle 512 and N.Ga.13; the de Havilland Gnome and Coupled Gnome, for which over £6 million of orders have already been received; and the Alvis Leonides Series 554 and Leonides Major Series 750. These last two engines, in both their helicopter and fixed-wing versions, are in service with 23 civil operators and the armed forces of 22 countries. Indication was given that up-rated versions of the 512 Series Gazelle, currently giving a 1,750-s.h.p. 2½-minute maximum contingency rating, are under way to give corresponding ratings of 1,925 and 2,000 s.h.p. for the 513 and 514 series.

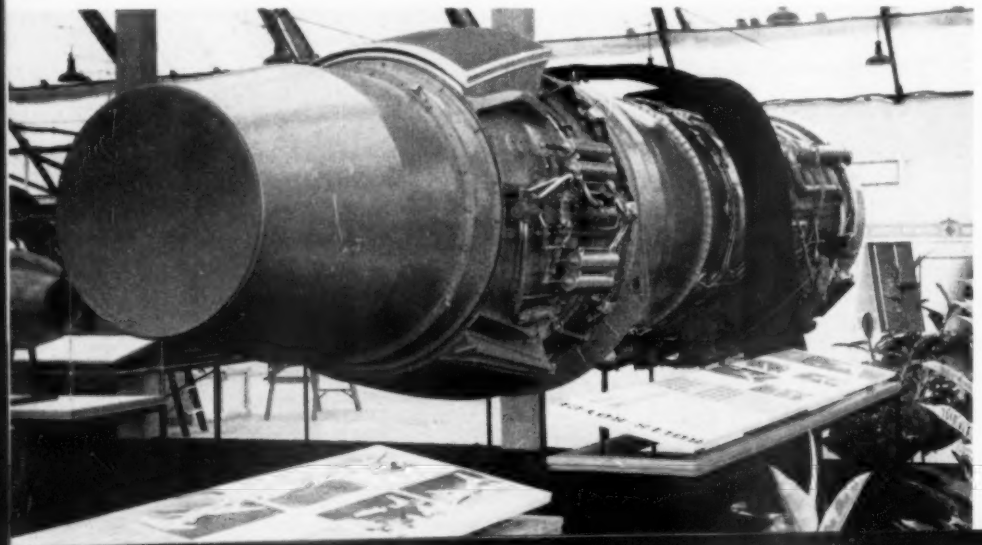
Blackburn, with their Turbomeca family of small turbines, exhibited five engines, including the Nimbus 1,100-s.h.p. shaft-drive turbine for helicopters; the very neat Cumulus air-bleed turbo-compressor delivering 2.38 lb. air/sec. at 56.5 lb./sq. in.; the Astazou, in both shaft drive and turboprop form; and an auxiliary airborne powerplant (AAPP) airbleed turbo-compressor, which both provides 2.4 lb. air/sec. and a shaft drive to a 40-kVA. alternator.

Few radically new engine accessories were on display, although the latest versions of many systems and components were shown. Lucas, who were emphasizing their research, development, design and manufacturing capabilities, had an unusually interesting exhibit in an engine flame which is being excited at one of its fundamental modes. The remarkable amplitude and phasing of the vibration were made apparent by the use of stroboscopic lamps flashing at a related frequency. Over a flame-tube diameter of around 10 in., an amplitude of vibration of approximately $\frac{3}{8}$ in. is achieved. An associated diagram listed the Lucas departments concerned with the mechanical, material and combustion problems of "canware."

Components on display associated with the de Havilland reheat Gyron Junior Javelin in the flying display were the Hobson reheat fuel system and the Dowty inlet-guide vane control. The Hobson system is in three units comprising a turbopump with two fuel controls, a streak igniter and the control for variable geometry exhaust nozzle. The controls ensure stoichiometric combustion at the minimum reheat condition and continuous control of thrust boost up to the full reheat condition. With one burner ring out of three performing continuously at stoichiometric fuel/air ratio it becomes virtually impossible for inadvertent reheat combustion extinction to occur.

Plessey, in addition to fuel system units, were displaying a new lightweight IPN starter providing safe, self-contained starting for medium-size turbine engines. The starter can also operate on external supply of low-pressure air.

In the engine materials field, High Duty Alloys, among a wide selection of light-alloy forgings, were showing two compressor blades of exceptionally large size, these presumably being early stage blades. One of the blades, it was interesting to note, had anti-flutter projections at mid-span, similar to those used on the large Pratt & Whitney engines.—K.T.F.



Something new in civil powerplant—the Rolls-Royce Conway RCo.42/1 turbofan is shown for the first time.

Second Show Report . . . .

Missile and Rocket Developments

APART from the appearance of Blue Streak hardware for the first time at Farnborough, this year's rocketry contribution will be largely remembered for the glimpse it has given of new and up-rated propulsion units. Considerable effort has been applied, within the Industry, to the task of squeezing extra performance from existing engine components and of applying ingenuity to the design of new low-cost systems, often with more than one specific application in view.

There was, for example, the Gamma Mk. 301 to enhance the performance of the Black Knight research vehicle, and the diminutive PR 37 rocket motor to boost the operational ceiling of the Jindivik target drone; both are products of the experienced team at Bristol Siddeley. From de Havilland came Spartan I, a packaged liquid-propellent rocket motor competing in the same class as the short-duration solid booster. And, of course, there was the Rolls-Royce RZ.2 engine, now in the process of being up-rated from 137,000 lb. to 150,000 lb. s.t. for service in the first stage of Europe's projected heavy satellite launcher.

This is not to imply that the airframe and electronics aspects of missile development were ignored, but for security reasons, there was little that could be shown of the "second-generation" Bloodhounds, Thunderbirds and Seaslugs which are now undergoing development trials. Adjacent to a Firestreak Mk. I attached to the gunpack installation of the English Electric Lightning, de Havilland were permitted to show a full-size representation of their Red Top development but this had already appeared earlier this year at the Paris Aero Show.

The English Electric Blue Water tactical missile, as we observed last week, was well in evidence and special mention is due to the men from the G.W. Wing, School of Artillery, Larkhill, who performed demonstrations of missile handling in a special tarmac display. Speed and efficiency, too, were in evidence from 37 G.W. Regiment, R.A., in bringing their Thunderbird Mk. Is to "action stations."

Bloodhound Development

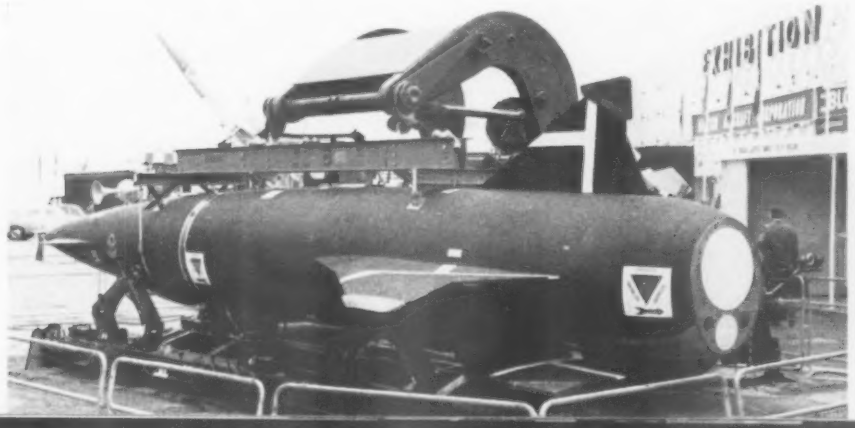
In the Guided Weapons Park was to be found the customary representation of British guided weapons. These included four Bristol Ferranti Bloodhound Mk. Is, with attendant A.E.I. Sting Ray target illuminating radar, and a placard reminder that Bloodhound Mk. 2 has "already been chosen to defend the U.K., Sweden and Switzerland."

Bloodhound electronics were available for inspection in a nearby Ferranti booth, including an example of the semi-active homing guidance head, used on Mk. 1, and a model of the

Right, specially designed for hypersonic research in the upper atmosphere, this three-stage Jaguar vehicle has been jointly developed by W.R.E. in Australia and the R.A.E.

Photographs copyright "The Aeroplane and Astronautics"

Below, the Avro Blue Steel ASM on the M.L. Aviation hydraulic loading trolley.



Second Show Report . . . .

Ferranti Fire Light continuous-wave radar "used for target illumination in the Bloodhound Mk. 2 system ordered by the Royal Swedish Air Force Board"; also related to the Mk. 2 were transistorized printed wiring units and a box of transistorized printed wiring cards similar to those used in a launch control post, "which is built around a compact digital computer."

Although this was the only "hardware" related to the improved Bloodhound on view, the British Aircraft Corporation was able to fill in a few background details. In the design of Bloodhound Mk. 2, full account has been taken of the considerable developments of the bomber threat: while the Mk. 2 closely resembles the Mk. 1 in external appearance, the weapon system has been said to offer striking advances in virtually every aspect of performance.

The most imporant single factor is the use of continuous-wave radar guidance. In addition to enabling Bloodhound's radar range to be extended, this has made it possible to achieve greater lethality against all targets down to very low altitudes, even in face of advanced electronic counter-measures. Similarly, advances have been made in the ground radar equipment which has already completed arduous test programmes.

Bloodhound 2 is powered by a new and more advanced version of the Bristol Siddeley Thor ramjet which gives even better range and altitude performance. In numerous test firings already carried out, a substantial number have been against aircraft flying at very low altitudes. These trials have proved outstandingly successful.

Examples of the A.W.A. Seaslug were again to be found in the Guided Weapon Park—one rigged to demonstrate the action of the movable tail blades—but there was little further information on the Mk. 2 Seaslug, which is now under development for the Royal Navy. "It will have the accuracy and dependability of the Mk. 1 plus longer range, better performance against low-flying targets, and surface-to-surface capability, and will require no modifications to existing shipboard environment."

Anti-tank Weapons

Malkara, the highly effective anti-tank guided weapon system, was seen on this occasion mounted on a lightly armoured vehicle which, with a crew of three, carries four of the 216-lb. missiles ready to fire. The range is well in excess of a mile.

Shorts have been content to show the Seacat Mk. 1, with emphasis on production hardware and actual test equipment—preferring the field of "solid accomplishment" to further glimpses of their project work. There was no hint at all of the company's private-venture "supersonic Seacat," disclosed at the Paris Aero Show.

Photograph copyright "The Aeroplane and Astronautics"

A model of the Ferranti Fire Light continuous-wave radar to be used for target illumination in the Bloodhound Mk. 2 system.

On the British Aircraft Corporation stand in the exhibition marquee was to be seen a realistic full-scale display depicting paratroops going into action with 50-lb. Vigilant anti-tank missiles, illustrating the weapon's adaptability for use in difficult terrain. It is the impressive claim that less than half the number of Vigilants are needed for a given task than of any comparable British weapon. Recent achievements have shown 95% missile reliability, 90% hits on vulnerable parts of tanks, and 86% hits by soldiers firing their first missile.

In marked contrast, B.A.C. were also able to show a half-scale model, beautifully finished in gold, of the UK Scout I. This, the first British-instrumented American-built satellite, scheduled for launching early next year, will contain two electronic "packs" developed and manufactured by Bristol Aircraft. These are an X-ray spectrometer, which will measure the incidence of solar X-rays over five energy bands, and an extra high-tension generator unit which will provide a highly stable 1,600-volt power supply to gas counter tubes used to detect radiation.

Research at Westcott

On the M.o.A. stand in the outside equipment exhibition, a colour film illustrated two new research techniques developed at R.P.E., Westcott. The first concerned the static-firing of a 17-in. solid-propellent rocket motor which had been fitted with a swivelling nozzle as a means of investigating control problems of solid rockets for high-altitude applications. Continuously oscillating at a frequency of $\frac{1}{2}$ cycle per second, the nozzle produced a side force of approximately 500 lb.

The second part of the film was devoted to the remarkable technique, developed at Westcott, which permits direct photography of the combustion process actually occurring inside a solid-propellent rocket motor. The motor itself takes the form of a steel tube 21 in. long by 5 in. diameter, filled with a star-shaped, case-bonded, propellent conduit. At the head end is a 2½-in.-thick Perspex window, to which the propellent is bonded to prevent burning.

Through the window, the cine-camera (using Ektachrome film at 3,000 frames/sec.) secures an intimate picture of the combustion process in which the star-shaped conduit is clearly seen receding at a steady rate. In this way it has been possible to determine that measured high-frequency pressure fluctuations occurring in the motor, in the range of 100 p.s.i., are associated with pulsations in the gas flow.

On the same M.o.A. stand was a model of a directional radar which is being built at the Royal Radar Establishment. With a 45-ft.-diameter "dish" antenna, it will have the accuracy and

(*Continued on page 367*)

A range of Bristol Siddeley engine components which can be combined in various ways. Left, large and small combustion chambers for Stentor. Right (top), the small PR 37 chamber, and (bottom) an experimental flight feasibility chamber for a four-chamber rocket engine of the type which could be applied in the third stage of a Blue Streak satellite launcher. All operate on HTP/kerosene.

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for turbojets
of up to
330 lb/sec mass flow

reduces ground noise by as much as 45 decibels

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WHAT DO YOU KNOW ABOUT HEATHROW?

Why call London Airport "Heathrow"?

Because there are two London Airports now—Heathrow and Gatwick—so 'LAP' has become London (Heathrow) Airport. And today, as jet airliners depart from London to span oceans and continents in a matter of hours, the name of Heathrow revives memories of a more leisurely age of less exotic transport: when, two hundred years ago, mail coaches took the Bath Road across Hounslow Heath, past the "Three Magpies" which still stands near the airport entrance, on the three-day long-haul run between London and Bath.

How long has it been an airport?

First built as an airfield for R.A.F. Transport Command in 1944, on the site of the Fairey Aviation Company's small grass aerodrome known in the 1930's as Harmondsworth (Heathrow), it was taken over by the Ministry of Civil Aviation at the end of 1945. The first proving flight was made in January, 1946 and the first passenger service was flown on June 1 of the same year.

How big is it now?

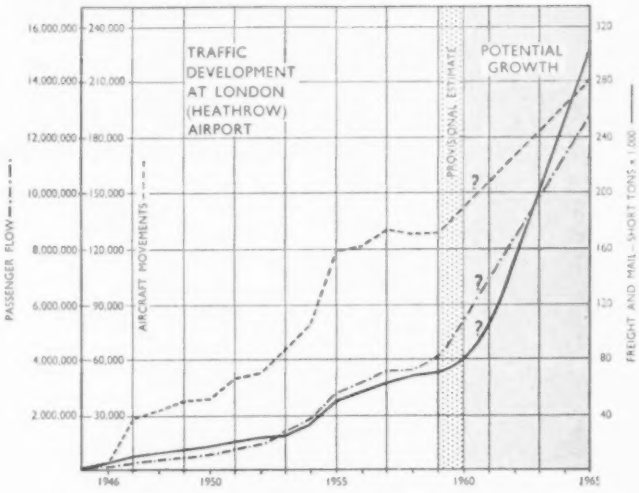
The airport covers 2,705 acres with a boundary length of 12 miles. There is enough concrete in the five runways, roads and taxyways to build a first-class road from London to Edinburgh. It's a town in itself and a busy one at that, with its own fire service, police force and bye-laws, a telephone exchange and a total staff of 28,000.

What's going on in the picture below?

This shows an Esso crewman in the control compartment of a Python refueller. These 55-foot-long Pythons are a familiar sight at London (Heathrow). Each has a capacity of 12,000 Imperial gallons. High-speed hydraulic motors drive the two centrifugal delivery pumps to provide a pumping rate of 1,000 gallons a minute—500 from each of two hoses. As always, precise filtration is a key factor in Esso service and all fuel supplied by the Python passes through 2½-micron filter separators.

How has traffic developed since 1946?

This graph gives the answer:



Today aircraft of 46 of the World's airlines make regular use of Heathrow and the airport is the busiest in the World outside the U.S.A.

What about Esso's share in all this?

With a staff of 130 and a fleet of nearly fifty refuellers, trailers and other mobile dispensing equipment to suit every need however large or small, Esso handles a million gallons of fuel a week at Heathrow. Its storage tanks at the Perry Oaks fuel farm hold this amount—plus nearly half as much again in the tanks at the Central Area Plant. And out at Perry Oaks Esso now has its own manufacturing plant for water methanol and demineralised water.

And how about the future?

Airport facilities are expanding rapidly. No. 5 runway is being extended to 11,000 feet, the long-haul passenger building now under construction in the Central Area is due for completion soon and a new permanent freight building should be ready in 1963. As for Esso's plans, they are based on the determination to stay two steps ahead of current demands, to provide safe service fast whatever the need and ensure that fuel service will never be a limiting factor for the rapidly-growing air traffic of tomorrow.

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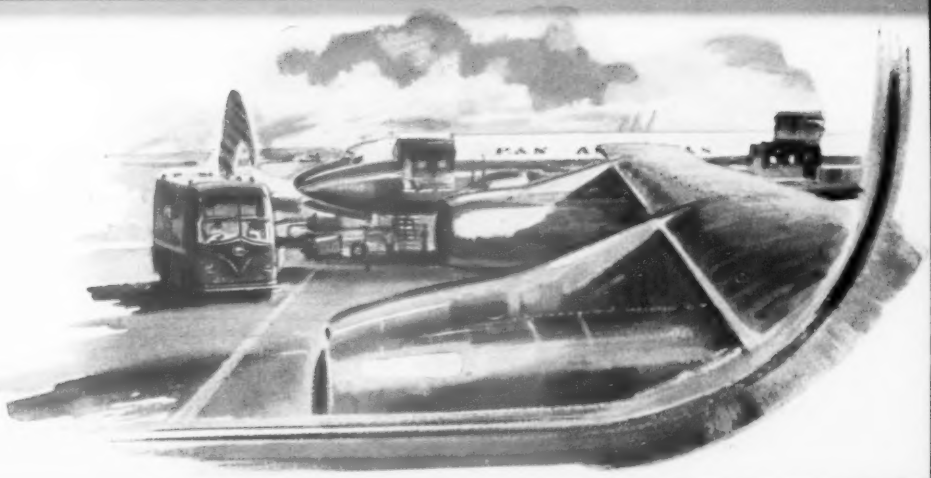

At the receiving end of calculated hustle: view from a cabin window of a Boeing 707 on the fuelling apron.

1615 on a winter's day at London Airport. A Boeing 707 of T.W.A. en route Frankfurt-New York receives fast Esso service.

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The Comet 4B, the big jet for Europe, brings European and Middle Eastern destinations closer than was ever dreamed possible. Powered by 4 Rolls-Royce Avon jet engines and with a cruising speed of over 500 m.p.h., the Comet 4B is a convincing reminder that BEA is Europe's Foremost Airline.

The new Vanguard, latest addition to the BEA fleet, is one of the largest airliners in the world. Powered by four Rolls-Royce prop-jet engines, it cruises at 425 m.p.h., carries 114 passengers and can carry its full payload in passengers or freight. With the Vanguard, BEA is well equipped to secure its share of European air travel.

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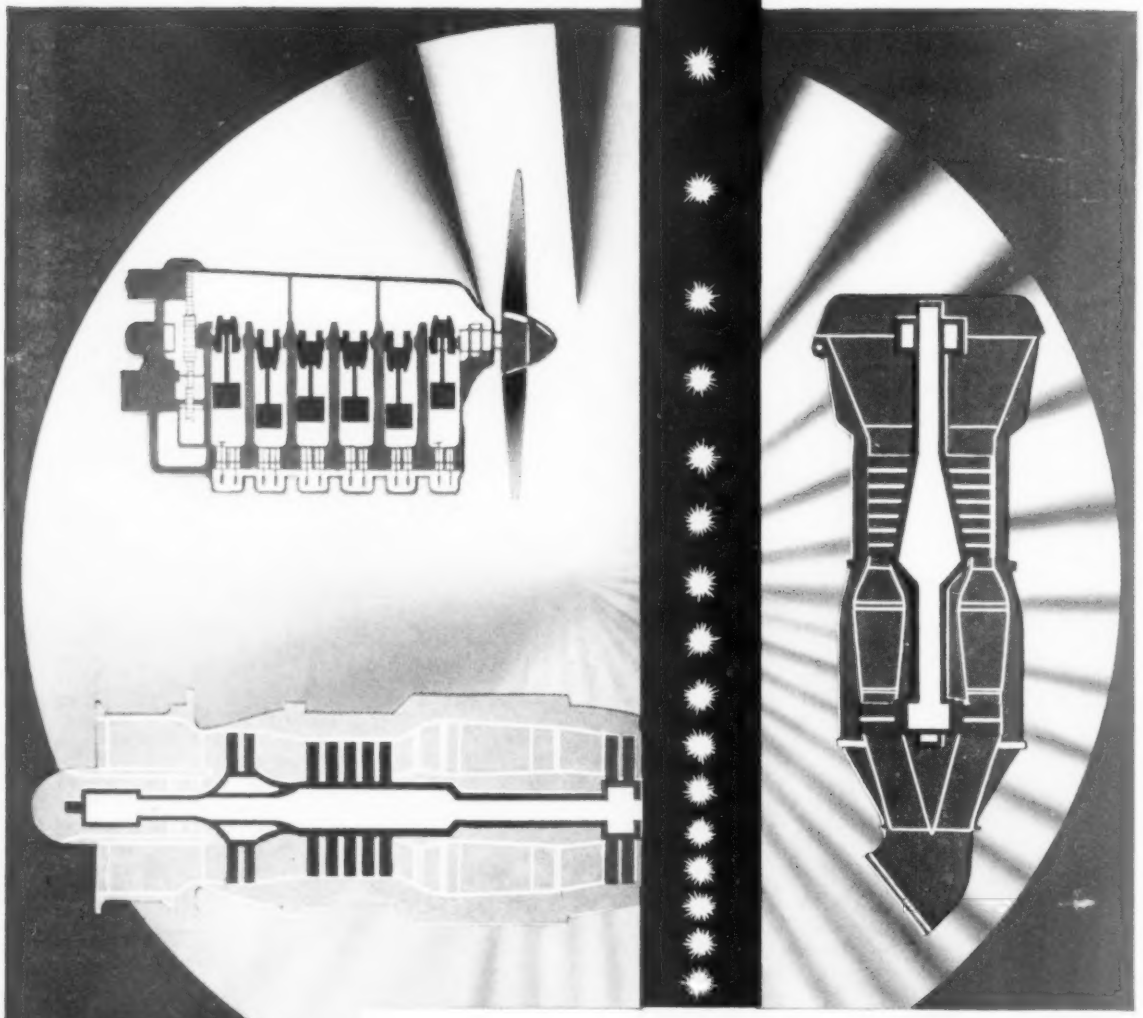
BRITISH EUROPEAN AIRWAYS

AEI GETS IT GOING



...AND KEEPS IT GOING

'Ignition on!' and an aircraft power plant bursts into life... AEI power starts it. Every electrical requirement for aircraft is met today by AEI, from ignition equipment for turbine or piston engines, to the supply of switchgear, generator sets, and the development of complete electrical systems for future flight projects. The efficiency and reliability of AEI electrical equipment is appreciated today by manufacturers and operators of leading aircraft of all types.

AEI

Associated Electrical Industries Limited
Aircraft Equipment Group
COVENTRY, ENGLAND

A1633

Second Show Report . . . .

(*Continued from page 366*)

speed of movement necessary for tracking artificial satellites and represents the type of equipment "which may be used in long-distance communication satellite work."

Although there was no fresh technical information available on the Avro Blue Steel "stand-off bomb," some indication of the problems of handling the missile in service was given by an R.A.F. demonstration in the Guided Weapons Park. The 35-ft. missile was shown being transferred from the transporter-unloader to the hydraulic loading trolley.

The transporter-unloader has been developed by A.E.C., Ltd., of Southall. The hydraulic loading trolley, which conveys the missile to the parent bomber and offers it up to the release mechanism, is the responsibility of the M.L. Aviation company.

In conjunction with the "hardware," A. V. Roe exhibited an interesting series of photographs covering various aspects of Blue Steel's development, production and flight trials.

Briefly, these various activities can be summarized as follows: Design teams at Woodford, Cheshire and London are concerned with the missile's structural, mechanical, electrical and electronic design. Associated contractors are de Havilland, Bristol Siddeley Engines and Elliott Brothers (Inertial Navigation Division). Sub-contractors include Whitworth Gloster Aircraft.

Laboratory and test work embraces propulsion, control, guidance, heating, cooling, fusing and arming and warhead systems; also the adaptation of V-bombers to carry the weapon.

Inspection teams work in close concert with design, development and production engineers in a constant effort to increase the missile's reliability. A defect-reporting system feeds back information to design teams.

Manufacture of Blue Steel structures and equipment is carried out at the Chadderton and Woodford factories of A. V. Roe. A special Electronic Production Unit has been established at Woodford for the manufacture of electronic components. Stentor engines and navigators for the missile come off the Bristol Siddeley and Elliott production lines.

An elaborate Trials Organization based at Woodford is responsible for the trials preparation, flight carriage and launching of missiles during the development phases of the Blue Steel programme. Information on the behaviour of the various missile systems is sampled, telemetered and recorded during flights, while kine-theodolite and radar traces of trajectories are obtained from the missile range.

A large Trials Organization exists in Australia for the flight testing of Blue Steel over extended ranges. Data is recorded on film and magnetic tape and reduced by the Trials Analysis Organization, which also prepares reports on all flight trials using modern computer techniques.

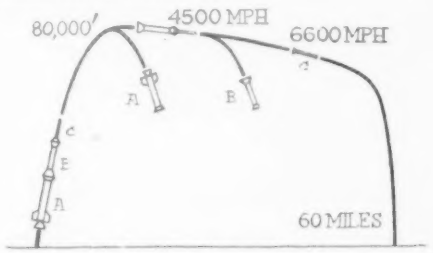
The Service requirement that Blue Steel should have extreme reliability and require "the very minimum of pre-flight attention" is reflected in the care with which each stage of the missile's development and production is controlled. This is naturally as much concerned with the engine as with the airframe and its internal systems.

Stentor engines in Blue Steel are required to remain ready for instant use when slung beneath V-bombers for weeks on end during routine standby periods over several years. Yet despite this, the twin-chamber Stentor is not fired from the time it leaves the factory until after the missile has been released from the parent aircraft. Flight experience so far indicates that the necessary high standard has been achieved.

To guard against corrosion, Bristol Siddeley have evolved special procedures and equipment for drying out the engine with hot air after the propellents have been drained. The engine is provided with suitable connection points so that each section of the propellent system can be dried out without breaking a single pipe joint.

Some parts of the engine remain in contact with propellents throughout the whole period of standby and special care has been taken to ensure that they remain in perfect condition. Bristol Siddeley report that standby and storage tests have confirmed that the engine is satisfactory over periods of several years under representative conditions.

Jaguar, briefly mentioned in our first report last week, has been a joint effort by the Aerodynamics Department of the Royal Aircraft Establishment and the Aerodynamics Division of the Weapons Research Establishment in Australia. All three stages make use of solid propellent rocket motors produced by the Rocket Propulsion Establishment at Westcott. Launching is carried out at Woomera.



Flight trajectory of the Jaguar hypersonic research vehicle.

Fired at an angle of about 70° to the horizontal, the first stage uses a Rook motor (not a Raven as previously reported) which burns for about six seconds; this accelerates the vehicle to a speed of about 3,000 ft/sec., after which the three stages continue to coast up to an altitude of about 80,000 ft. Shortly after reaching the peak of the trajectory, when the vehicle is inclined about 10° downward, the second stage Gosling motor is fired by radio command from the ground. The combined second and third stages then accelerate in three seconds to a speed of 5,500 ft/sec., after which the final stage Lobster motor is ignited automatically and this stage separates and continues to accelerate up to about 10,000 ft/sec.

Measurements of temperature, pressure and acceleration, made throughout the flight by instruments carried within the head of the third stage, are telemetered to the ground. Trajectory and velocity data are obtained by a combination of radio-Doppler, radar and optical tracking devices.

The small meteorological rocket being developed by British Aerojet for the Meteorological Office is expressly designed to ascend into the region between 30 to 60 miles above the Earth which cannot be reached with balloon-borne instruments and yet is too low for investigation by artificial satellites.

As the rockets may be used in places where the area available for the empty motor cases to descend is severely restricted, the safety of the trajectory has been a primary consideration. Dispersion is due almost entirely to wind deflection of the path of the rocket just after launching and is reduced to a minimum by the rocket's high initial acceleration.

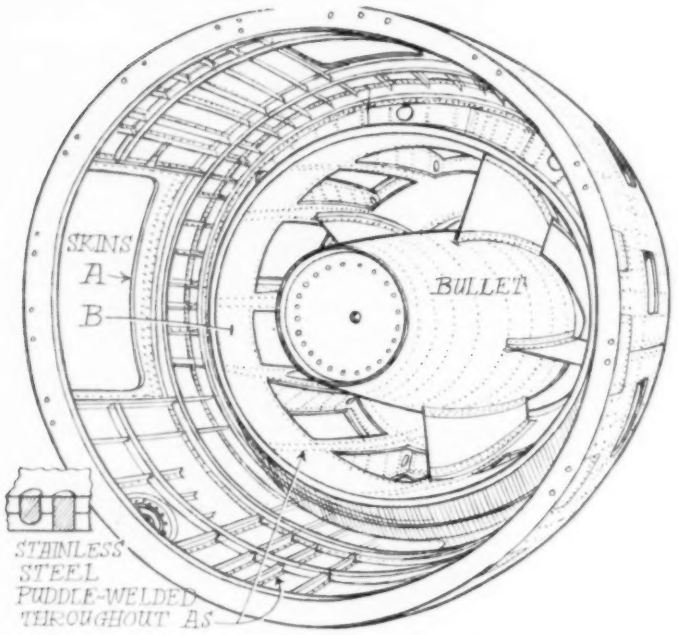
Technical data: Overall length 7.5 ft.; launching weight, 81 lb.; all-burnt weight 31.5 lb.; burn-out 48,000 ft.; maximum velocity, Mach 4.3; initial acceleration 50*g* for 0.2 sec.; flight acceleration 12*g* max.; launch velocity 300 ft/sec.

In the Army's guided missile compound at the foot of the hill, the English Electric Thunderbird and its vehicles were well in evidence.

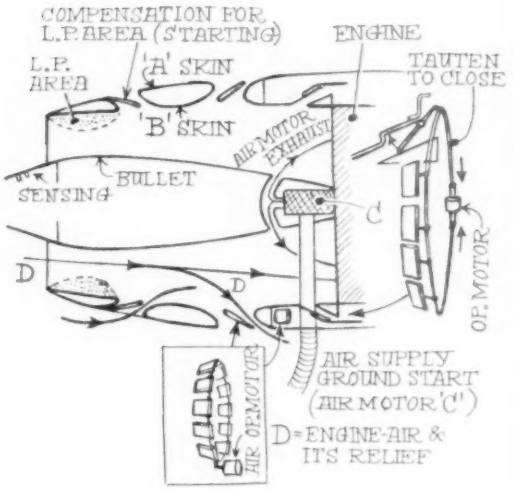
Second Show Report . . . .

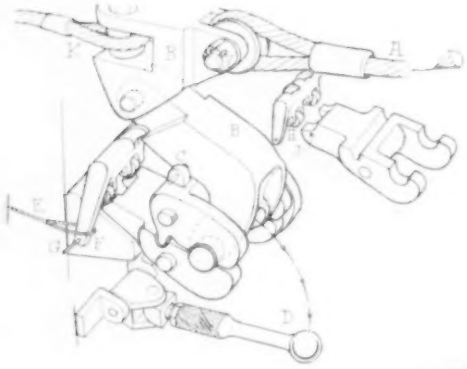
DETAILS BY J. H.

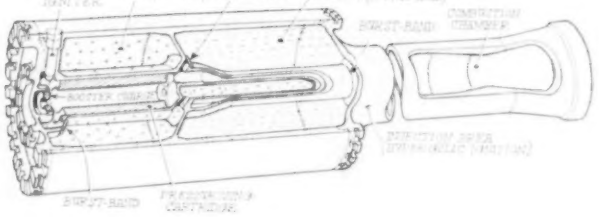
© Temple Press Limited, 1961



BRISTOL 188 ENGINE NACELLE DETAIL—welding in difficult places



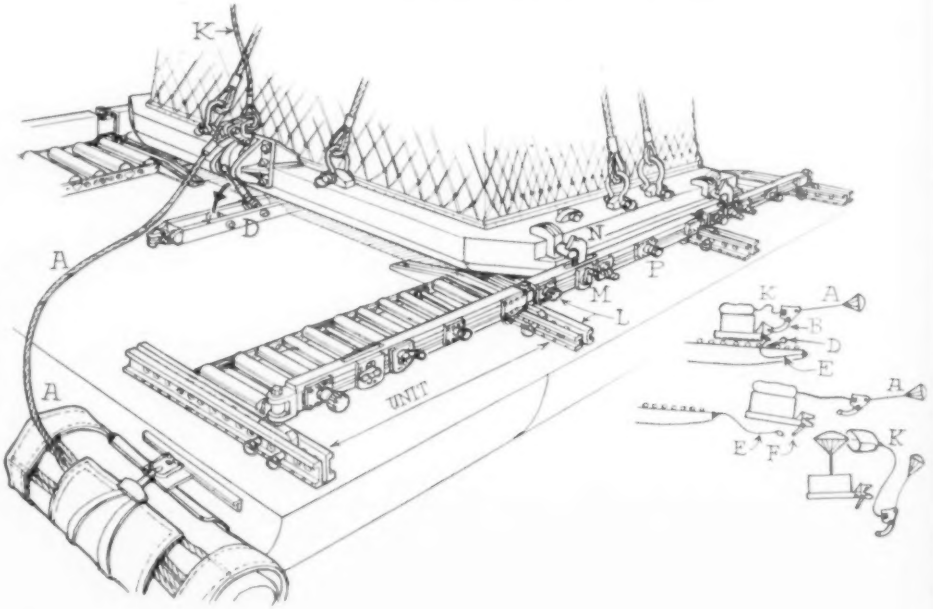




D.H. SPARTAN ROCKET MOTOR

BLACKBURN LAUNCHER

Pilot releases A. Parachute A pulls B, shears C (wire), D drops out. (D holds pallet against forward movement) A thus pulls load off aircraft. E tautens, pulls F, G shears, E slips off F. Rollers H clear J, jaws open. A/B floats off with cable K which opens main parachute.
L—Unit-lock to transverse members. M—Vertical and horizontal adjustments to claw N. P—Pallet-lock (when not dropping).

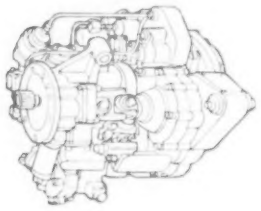


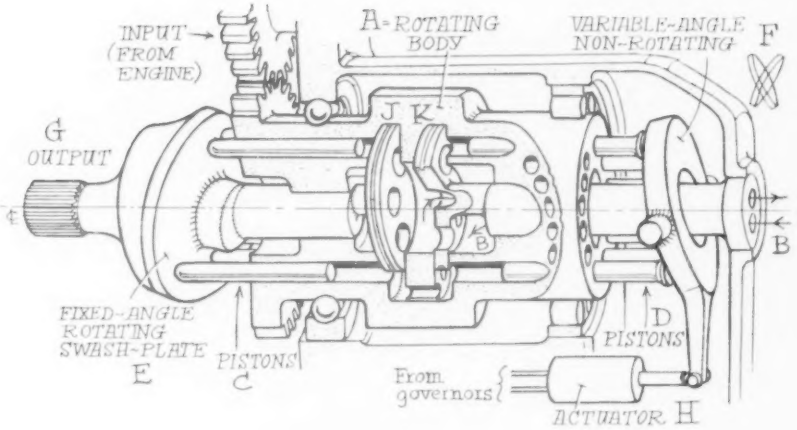
CLARK

Three Constant Speed Units—

1, ENGLISH ELECTRIC

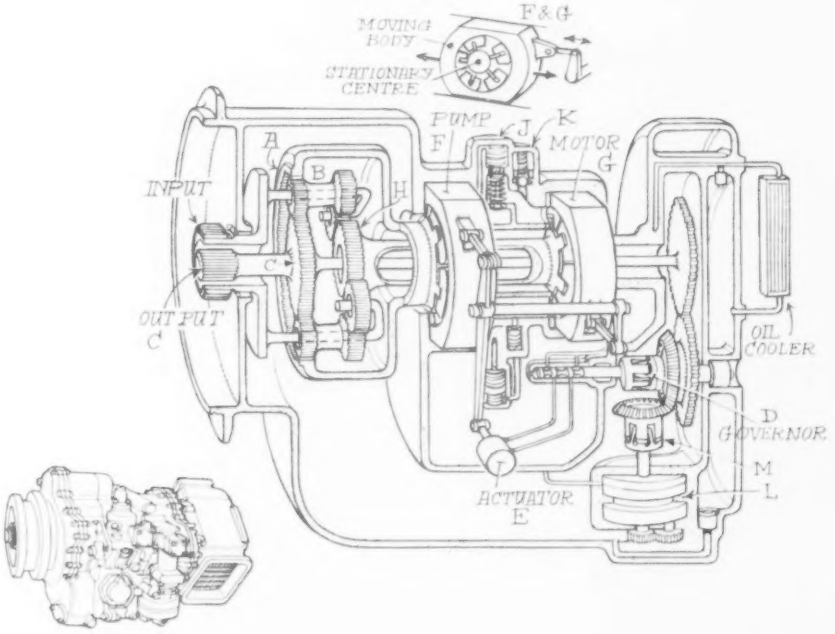
Engine input rotates A. Pressure-oil B keeps pistons C and D against swash plates E and F. With F neutral, A will drive E via C for correct output G. Speed variation at A operates basic governor, magnetic trim or limiting governor to operate H and rock F to provide piston-stroke D and oil pressure on C and E to adjust speed G. Port-plates J and K are eccentric to couple-up all opposed pistons C and D in turn per rev. of A.

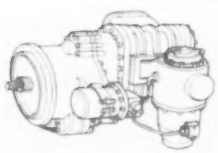


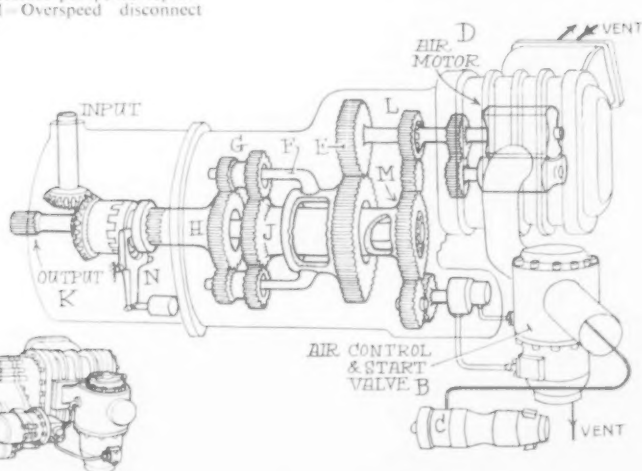


2, H. M. HOBSON

Ground Idling: Pump loaded, so ring A stationary. Engine drives B around A and C rotates at correct speed. Engine speeds up. Output C up. D moves E to unload F (and load G). Ring A moves, so B loses motion and C slows down to correct speed.
Cruise: Ultimately F spins, non-pumping, no torque reaction at A, but G now fully loaded so ring H drives B to react input torque. Output C rotating at correct speed. Higher engine speed means reversal at H to counter increased revs. at B. J=Unloading valve; short-circuits loaded pump to relieve bearings of unloaded motor G, and vice-versa. K=Overload relief valve. L=Charge pressure pump, air separator. M=Overspeed disconnect governor.







3, PLESSEY

Constant Speed *Idling up to cruise:* Governor A signals B to pass bleed-air C to air motor D. Motor D drives E and F to speed-up G already transmitting from H to J from engine. J—and, therefore, output K—thus runs at proper speed. *Cruise to maximum* Bleed-air cut off. Motor D now rotating in opposite direction as brake on J and venting.
Engine Starting: D driven by ground supply. Clutch L automatically engages to drive engine via, M, J, G, H.
CSU Ground Running: Disconnect clutch N. Drive K via M, L, D.
Flight Emergency Drive: Disconnect N. Air-bleed from other engines applied as in ground running.

Second Show Report . . . .

Airborne and Ground-based Electronics

DURING the short week of a Farnborough exhibition it is impossible, even for the specialist, to take stock of more than a few of the new devices. In our first report issue, last week, we picked out some of the more obvious trends in the electronics field and briefly described a few of the new items of equipment to be seen on the 340-odd stands both inside and outside the main exhibition tent. In this report some of these new exhibits are dealt with in greater detail and other interesting items are described.

Autoland and Pilot Flight Presentations

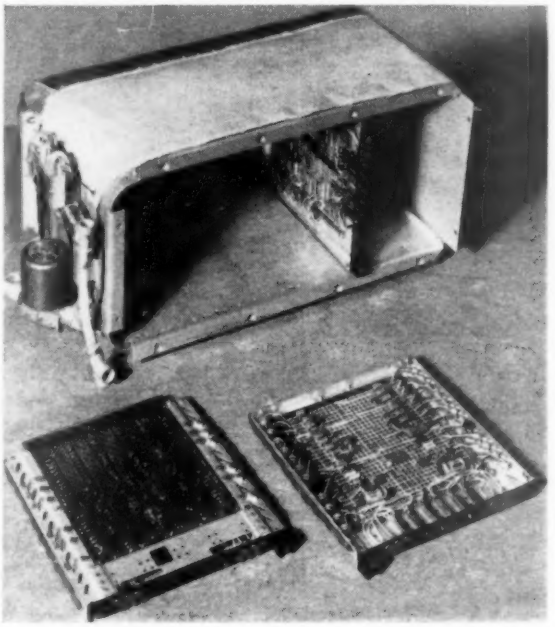
One of the most interesting groups of airborne electronic exhibits were those devoted to the very vital fields of automatic landing and pilot flight-information presentation and control systems. The R.A.E. pilot's electronic eye-level presentation system (PEEP) was featured both by the Ministry of Aviation and Rank Cintel, and multiplex autoland equipment and the para-visual director (PVD) system were the main attractions of the Smiths Aviation Division display.

Progress in British autoland developments and the "head-up" type of cockpit presentations are now well into the hardware stage for both production and flight evaluation installations. In addition to offensive military aircraft applications, all three systems—autoland, PVD and PEEP—are now being incorporated or studied for possible use in future R.A.F., B.E.A. and B.O.A.C. transports. A number of overseas military and civil authorities are also undertaking flight trials of some of these developments.

Apart from the combined Smiths SEP.5 autopilot system and twin PVD installations for the B.E.A. Tridents, which will be operated initially at duplex flare-out level, the SEP.5, at fully triplex autoland level, is going into the Short Belfast for R.A.F. Transport Command. Due in service in 1964, the Belfast will also be the first transport aircraft to have the R.A.E.-developed PEEP system. This pilot presentation system is also expected to be selected for installation in the five Vickers VC10s recently ordered for the R.A.F.

Overseas contracts for B.L.E.U.-type autoland equipment now include the DC-7 installation which is to be evaluated by the F.A.A. at Atlantic City; a German Noratlas experimental system for a trials programme being planned at Hamburg; and a prototype installation ordered for the Transall. In addition to these single-channel installations, which are planned to be completed next year, SEP.5 certification for the Trident and Belfast multiplex systems is now under way, including Belfast installation flight trials in a Comet 2E and Varsity.

A number of PVD evaluation programmes are also in progress or planned. K.L.M. is now flying a DC-8 with such an installation, which is to be raised to "second-stage" level to give flare-guidance during approach and landing; PVD equipment has been supplied to Boeing for flight trial evaluation in their Dash Eighty (707 prototype) aircraft; Sud Aviation are going to install PVD in a Caravelle; B.O.A.C. are to have a trials installation in a 707 to evaluate the system for possible installation in their VC10s; and the R.A.F. is studying its possible applications.



Details of the Decca Radar environment stabilization system showing the method of construction of an electronic cabinet. The upper unit is a cold plate surrounded by a heated blanket. Transistors are arranged at the top and bottom edges of the circuit boards. A picture of a complete installation appeared in last week's issue (p. 307).

It is understood that the United States is determined to have the ICAO specification for ILS raised to a level suitable for providing automatic-type landing guidance. The aim is to eliminate the leader cable requirement and thus do away with the associated ground and airborne installations.

The PEEP display for the Belfasts of Transport Command is expected to incorporate flight director, attitude, speed and, possibly, height information. The aircraft's standard-type primary flight instrumentation will remain. Up to the present time R.A.E. flight trials of the PEEP system have been undertaken with a Meteor T.7, but a Hunter T.7 is expected to be ready next year for more advanced work, including ILS approaches.

A.T.C. Developments

Although there was nothing specifically new about the demonstration by the M.o.A.'s A.T.C. Experimental Unit, this was extremely interesting as showing how simulation methods can be used to study traffic control problems and to devise appropriate solutions for them.

The demonstration at Farnborough was, in effect, a scaled-down variant of the real thing—with the single airways procedural progress board, its associated radar monitoring and televised writing-desk positions being fed first with actual

(*Continued on page 371*)

Photograph copyright "The Aeroplane and Astronautics"

On show for the first time was this Ferranti Type 100 intermediate size stable platform. Seen mounted in a transparent display sphere, it incorporates three Kearfott single-axis accelerometers, two Minneapolis Honeywell gyros and a Kearfott gyro, all of which are manufactured under licence.

FR MK20 Refuelling Pack

* **COLLAPSIBLE DROGUE** *folds when fuel hose is retracted*
* **MORE COMPACT POD** *which houses folded drogue*

The FR Mk 20 Refuelling Pack—the unit that rapidly converts a fighter into an aerial tanker—now incorporates two major modifications which result in a more compact, more streamlined shape for the pack, with correspondingly less drag.

This unit is capable of refuelling another aircraft at a rate of flow of 150 gallons per minute at a constant 50 p.s.i.

The pack is designed to accept fuel from the carrying aircraft to supplement the supply required by the receiver aircraft. Should refuelling not take place, fuel from this pack can also be used to augment the carrying aircraft's own supply. Jettisoning is provided for emergency conditions.

Illustrations show Scimitar-to-Scimitar refuelling with the Mk 20 Unit (photo by G. Woollard of Vickers-Armstrongs, South Marston) and the pack during ground testing at Tarrant Rushton (note photo showing drogue folded and stowed).

The Mk 20 Unit is scheduled to go into service with SCIMITAR and SEA VIXEN aircraft of the Royal Navy.

Flight Refuelling Ltd.,

Tarrant Rushton Airfield, Blandford, Dorset.

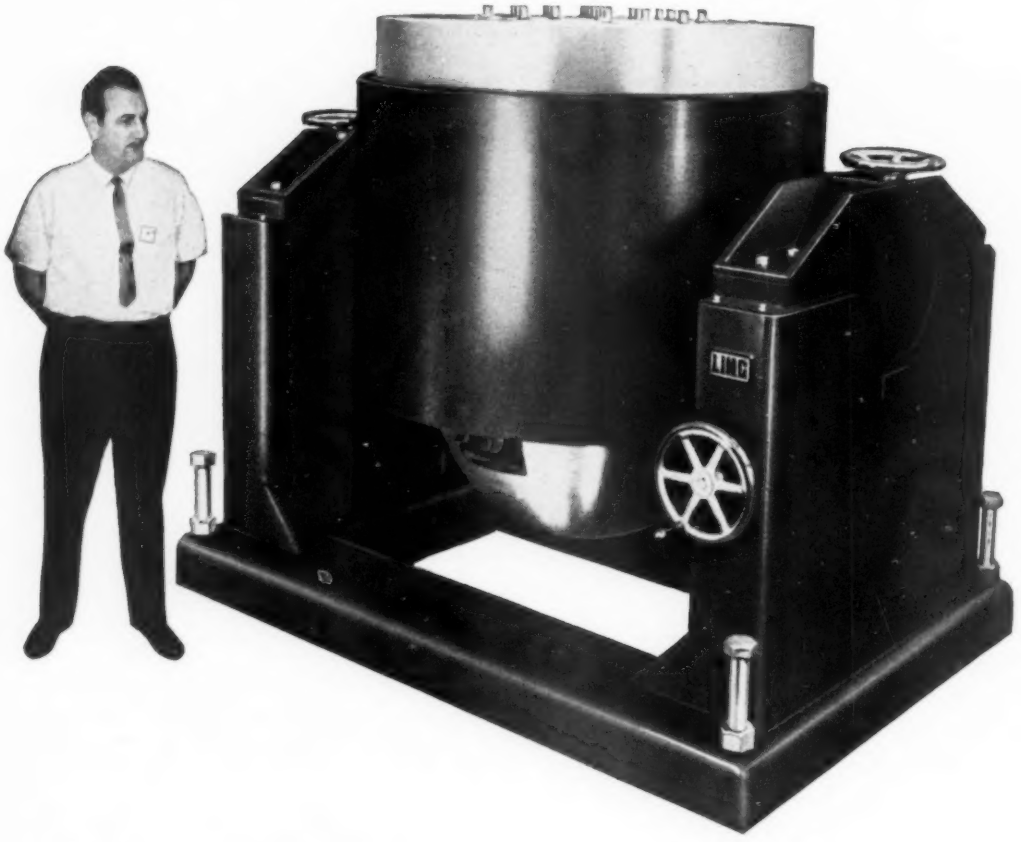
Telephone: Blandford 501.

Telegrams: Refuelling Blandford.

TA 6006

NOW IT'S PYE LING

A NEW FORCE IN ENVIRONMENTAL ENGINEERING



Pye, one of the foremost names in British electronic engineering, has now consolidated the achievement of its subsidiary, W. Bryan Savage Ltd, and at the same time broadened the scope of its activities by bringing it into association with the great Ling Temco Vought Corporation of America to form a new Company, PYE-LING LIMITED. This organisation will produce a range of Vibration and Fatigue Testing equipment that will be unmatched throughout the world for comprehensiveness and quality. The resources and experience of both the Pye Group and Ling will ensure that the British Aircraft Industry will have immediately available the precise equipment it requires for the proving of every type of component.

The Liquid Cooled Vibrator illustrated has a Thrust Rating of 30,000 lb. and is the largest of a comprehensive range which starts at 25 lb.

PYE LING
VIBRATION ENGINEERS

PYE-LING LIMITED, 7-8 DALSTON GARDENS, STANMORE, MIDDLESEX

AP. 13

Second Show Report . . . .

(*Continued from page 370*)

(recorded) traffic situations and then with simulated air traffic problems.

These simulated problems were fed in from five instrument positions at which part-time assistants—who have been taught the RT jargon and the limitations of transport aircraft operation—act as "captains," call up the imaginary A.T.C. centre to give their positions and to ask for instructions; they then proceed with the necessary modifications to altitudes, headings and so forth. These modifications, given by the experimental unit controller (or by a trainee controller, as the case may be), are duly simulated on the progress board and radar display so that their effects on the total traffic situation can be watched and further necessary modifications made to the traffic flow arrangements.

This dynamic simulation system was originally intended, in the main, for the study of A.T.C. problems and the testing of new equipment, but is also being used more and more as a means of providing real-life training for procedural and radar controllers. In the demonstration at Farnborough there were only five "captains'" positions providing the simulated movements of five different aircraft; at the experimental unit there are 15 such positions and there will, in due course, be 60 at the Hurn (Bournemouth) centre.

The entire demonstration—including both the 10-minute period of recorded traffic situations and the superimposed simulated traffic movements—was almost startlingly true to life and real action had to be taken from second to second by the controllers. The equipment shown included closed-circuit television, which is used as a means of relaying and displaying flight data at the control positions from a "TV writing desk."

One of the recent problems which has been studied by the experimental unit was that of the traffic over the Thames Estuary, as this was related to the Southend Airport control system. The actual traffic was first recorded, studied and reported upon; then simulation was used to develop effective new procedures both for the Southern Air Traffic Control Centre and for Southend control itself.

Among the next steps in simplifying and co-ordinating the air traffic controller's work will be the introduction of automatic data processing and data display. Elliott Brothers—who are now engaged in the development of an experimental A.T.C. system based on a digital computer—were, as we explained in last week's report, demonstrating the practical use of a standard general-purpose digital computer (the Elliott 803), which had been programmed to complete various A.T.C. and similar functions.

Calling on its very complete "memory" store, the computer (and its teleprinter) provided answers to all normal E.T.A. and traffic "conflict" questions on a simple airway system which could be used by 60 or more different aircraft. It also simulated aircraft movements and interception on a PPI display; operated an airline seat-reservation system; and acted as an automatic telegraph switching centre for a closed communications network. The whole of the detailed work of programming the computer for these complex operations had been completed in the few weeks prior to the Farnborough Show.

Radar will begin to come into its own as a primary control, rather than as a monitoring aid to traffic control, when secondary radar is fully developed and in overall use—in other words, when transponders in all aircraft can supply automatic identification and other essential operational information to match the echoes on the radar displays. Cossor were showing components of their SSR system—the ground equipment for which has been engineered to an M.T.C.A. (M.o.A.) specification and meeting ICAO requirements, and with a transponder designed in accordance with ARINC characteristics 532B. The pulses from the ground station trigger within-range airborne transponders to transmit any one of 64 different reply codes.

Two of Marconi's exhibits in the field of A.T.C. development—the combined synthetic radar display unit, and the parametric amplifier and mixer—were briefly described in last week's report. Also of special A.T.C. interest was the tabular display unit for the conversion of digital information into cathode-ray tube characters. This information, fed from a data-processing computer or processor, is converted directly into characters on the face of a CRT, thus saving time over more conventional output handling through teleprinters.

Pictorial Navigational Displays

Developments in two basic types of pictorial map presentations were to be seen. The "moving map" display was featured on the M.o.A. and Ferranti stands, and "roller map" units were shown by The Decca Navigator Company.

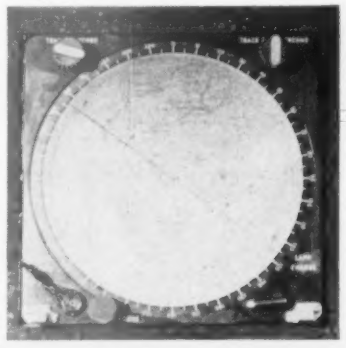
Originally designed by the R.A.E. and now being engineered and produced by Ferranti, the moving-map display system for presenting navigational position and track information was first exhibited earlier this year at the Farnborough "open day." Primarily a navigator's aid for low-level high-speed aircraft, it employs aircraft present position and track markers, superimposed on an optically projected moving map.

Capable of being fed by any airborne navigational equipment producing outputs in the form of grid ground miles and track angle—such as Doppler or inertial systems—the moving-map display can be either track-established or north-stabilized. The maps are reproduced on 35-mm. colour transparencies, each representing one standard 1-in-500,000 aero chart. A total of 140 such map transparencies, each covering an area of 170 naut. miles by 120 naut. miles, can be loaded in strip form at any one time for projection on to a 6-in.-diameter ground-glass screen at a scale of either 1 in 500,000, or 1 in 1,000,000.

Aircraft position is indicated by a circular marker in the centre of the screen and a radial cursor is superimposed on the map and graduated in strips of 5 naut. miles. Lengthwise movement of the film strip corresponds to change of eastings and sidewise movement to change of northings. North-south map changes can be automatic, but manual operation is required for east-west map changes.

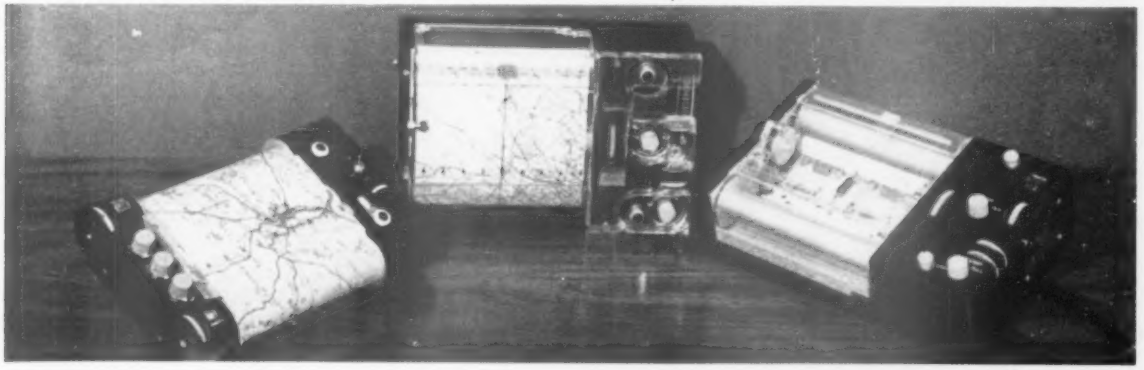
Three types of Decca roller-map units are now in production for the Services. Two are designed for use with Doppler or inertial navigation systems and one is a self-drive unit for fitting in front of other cockpit instruments.

All three units provide a continuous visual presentation of aircraft position on a standard aero chart and are based on techniques developed with the Decca Flight Log. In the two which accept automatic navigation system inputs, movement



The R.A.E. "moving-map" display featured on the main M.o.A. stand. As described above, it has a 6-in.-dia. ground-glass screen, two presentation scales and can be either track-established or north-stabilized.

Below, three different types of roller-map units were exhibited by Decca. Providing a continuous visual presentation of aircraft position, they are based on Flight Log techniques.



Photographs copyright "The Aeroplane and Astronautics"

Second Show Report . . . .

across track is shown by lateral displacement of an arrow, and all three units show aircraft progress along track by movement of the map below the arrow. Measuring approximately 8 in. × 5½ in. × 2 in., they weigh between 3½ and 5 lb.

Accurate and Simple DF

The new Standard Telephones direction finder—demonstrated on the outside radar site—is a departure in design from normal long-base DF techniques and makes use of a true, rather than a simulated, Doppler effect. The rapidly rotating (180 r.p.m.) 12-ft.-diameter aerial, which provides this Doppler effect, has had its aerodynamic drag reduced and absorbs only about ½ h.p.

For the demonstration at Farnborough the receiver was monitoring the London-Paris Amber 1 airway frequency and RT signals were coming up fairly frequently. The indicator—which is of the simple electromechanical lighted-needle type—produced dead-beat bearings in less than a second after an aircraft's transmission had started.

The main practical features are simplicity, in terms of understanding, operation and servicing, and a low first cost. The system had been designed primarily for use on secondary airfields, but the standard of accuracy is high enough for the equipment to be considered for use at any airfield.

Environment Stabilization

The application of environment stabilized transistor engineering in radar display and data-handling systems was, as described in our preliminary report last week, demonstrated by Decca Radar. Shown in the form of the company's new TDS Mk. V equipment, this technique employs an integrated liquid cooling system combined with electrical heater circuits to overcome the instability of transistors and to maintain all the electronic units at a preset constant temperature to within ±0.25° C.

By using an integral refrigeration unit and heat exchanger, coupled with thermally insulated reinforced glass-fibre cabinets—thus making possible the more reliable conversion from valves to transistors—Decca have introduced a number of important improvements in this type of electronic equipment. The overall size and power requirements of a fully transistorized display system are reduced by a factor of approximately 10 by comparison with equivalent valve equipment; integral wiring has limited the number of inter-unit connections and therefore greatly reduced laboratory and on-site installation costs; and the problem of heat dissipation has been overcome.

But by far the greatest result claimed by this development has been the improvement in reliability. During prototype trials, which have now exceeded 10,000 hours, an availability rate of over 99.75% has been achieved. Only two component changes, involving a total close-down period of approximately 22 hours, have been necessary during this continuous evaluation period.

The TDS Mk. V system consists of central display drive equipment with associated transistorized viewing units. The drive equipment is built on a modular basis and a basic group consists of up to three electronic cabinets operating in conjunction with one power and coolant cabinet. Each electronic cabinet contains three open cold plates which house the printed circuit boards. Controlled by individual temperature-sensing systems, the cold plates are surrounded by heater blankets to maintain their surfaces at a stable temperature, normally set within the 20-25° C. bracket.

Initiated by Decca as a private venture, this transistorized radar display and data-handling system now has Ministry support. The first production equipment is now completing its acceptance trials prior to delivery in a military project.

Light and Executive Aircraft Aids

Communications, navigation and autopilot equipment for the lighter single- and twin-engined aircraft were well represented this year.

A Cossor subsidiary, Communications (Air), Ltd., exhibited an A.R.B. and M.o.A. Class-One-approved 100-channel VOR/ILS equipment. Known as the C.A.2, this comprises a receiver/navigation unit, a cockpit controller and a combined ILS/VOR indicator. Automatic or manual VOR selection is available within the 108.1-117.9 Mc/s frequency band and the indicator unit has normal cross-pointers for ILS presentation. On selection of a VOR beacon, a compass card mounted round the periphery rotates to give bearing information in conjunction with the vertical ILS needle. The U.K. price is about £1,600.

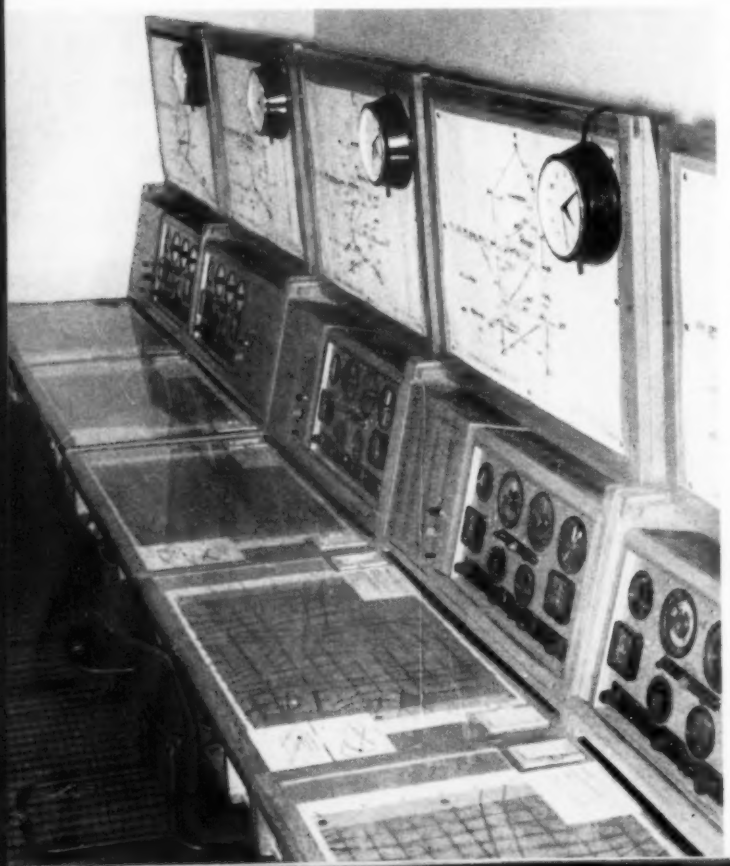
The Beagle-Masefield B.206 prototype instrument-panel mock-up seen on the Smiths Aviation Division stand. It contains modified existing Smiths flight instruments, a Motorola VHF comm./nav. installation and "car-type" engine instruments.

Standard Telephones showed an unfinished laboratory model of the low-power version of their new STR-37 VHF transmitter/receiver. Providing 400 switched channels at 50 kc/s spacing in the 116-135.95 Mc/s range, this self-contained unit is designed for use in light aircraft or for stand-by installation in larger types. A matching independent three-unit navigation system comprising ILS/VOR/marker receivers and instrument drive is at present under development. The basic STR-37 transmitter/receiver measures 3.75 in. × 5.75 in. × 7.8 in. and weighs 6.5 lb.

A panel-mounted VHF transceiver with separate modulator and power pack was featured by Elliott Brothers. Providing 720 communications channels at 50 kc/s spacing in the 108-144 Mc/s band, this installation is priced at under £650, including mounting tray, connectors and crystals.

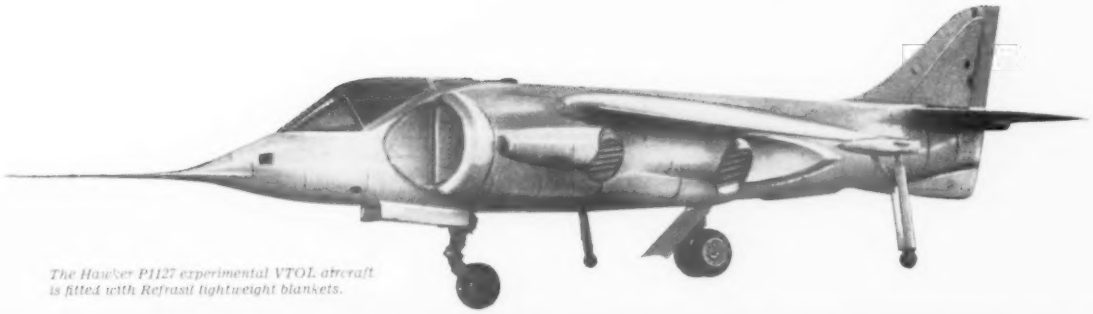
Smiths Aviation Division exhibit included an instrument-panel mock-up of the Beagle-Masefield B.206 prototype. This contained a mixture of "car-type" engine and other instruments, modified existing Smiths flight instruments units and a Motorola M-135 VHF comm./nav. installation.

Smiths are supplying instruments for all the Beagle range of light and executive aircraft and are planning to produce Motorola VHF equipment under licence in the United Kingdom. This will have Class One M.o.A. approval with a limiting all-up weight restriction.



Photographs copyright "The Aeroplane and Astronautics"

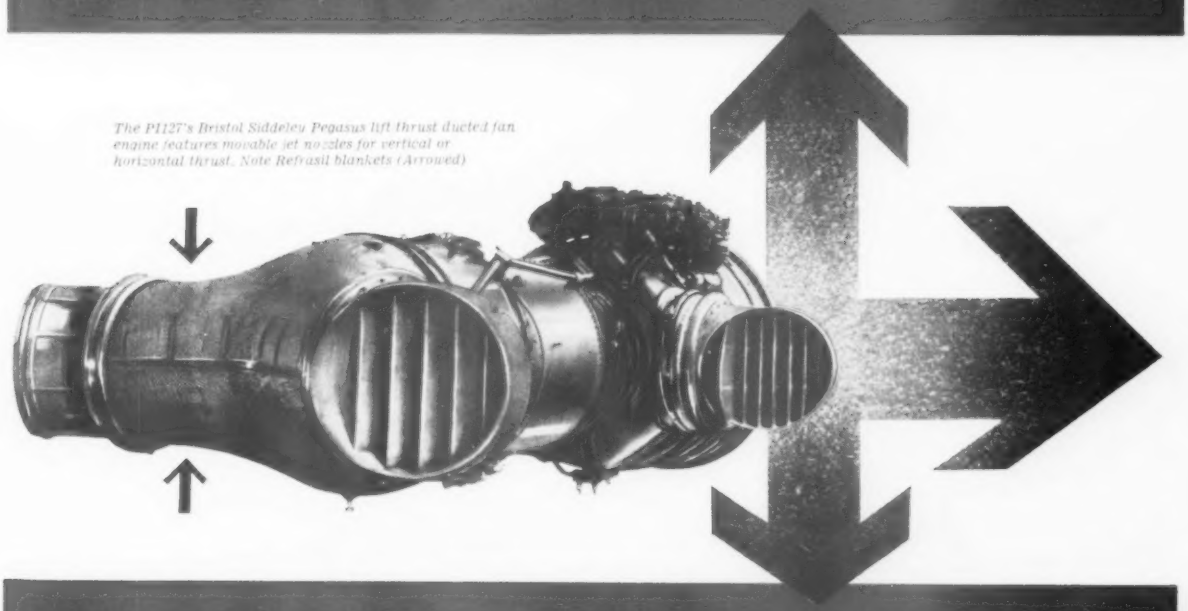
The A.T.C. Experimental Unit demonstrated the way in which aircraft movements can be simulated during the study of traffic-handling problems. These are the control desks at which the "pilots" operate the individual aircraft entering the simulated traffic pattern.



The Hawker P1127 experimental VTOL aircraft is fitted with Refrasil lightweight blankets.

FOR V.T.O.L. OR CONVENTIONAL AIRCRAFT

The P1127's Bristol Siddeley Pegasus lift thrust ducted fan engine features movable jet nozzles for vertical or horizontal thrust. Note Refrasil blankets (Arrowed)



... REFRASIL INSULATION

SINCE THE EARLY DAYS of jet aircraft, Refrasil has played a vital part in high temperature insulation. Today Refrasil is used in most experimental projects, including the Hawker P1127 VTOL aircraft, as well as the majority of British production engines and aircraft. Why? Because Refrasil blankets can withstand continuous temperatures of 1,000 C. Further, they are precision made to the specific needs of a development programme or other application. A prototype shop is an invaluable part of the Design, Technical, Advisory and Maintenance services operated by Darchem Engineering before and after sale. And, another production point: no aircraft programme has ever been held up for deliveries. Whenever you have an insulation problem consult Darchem Engineering.

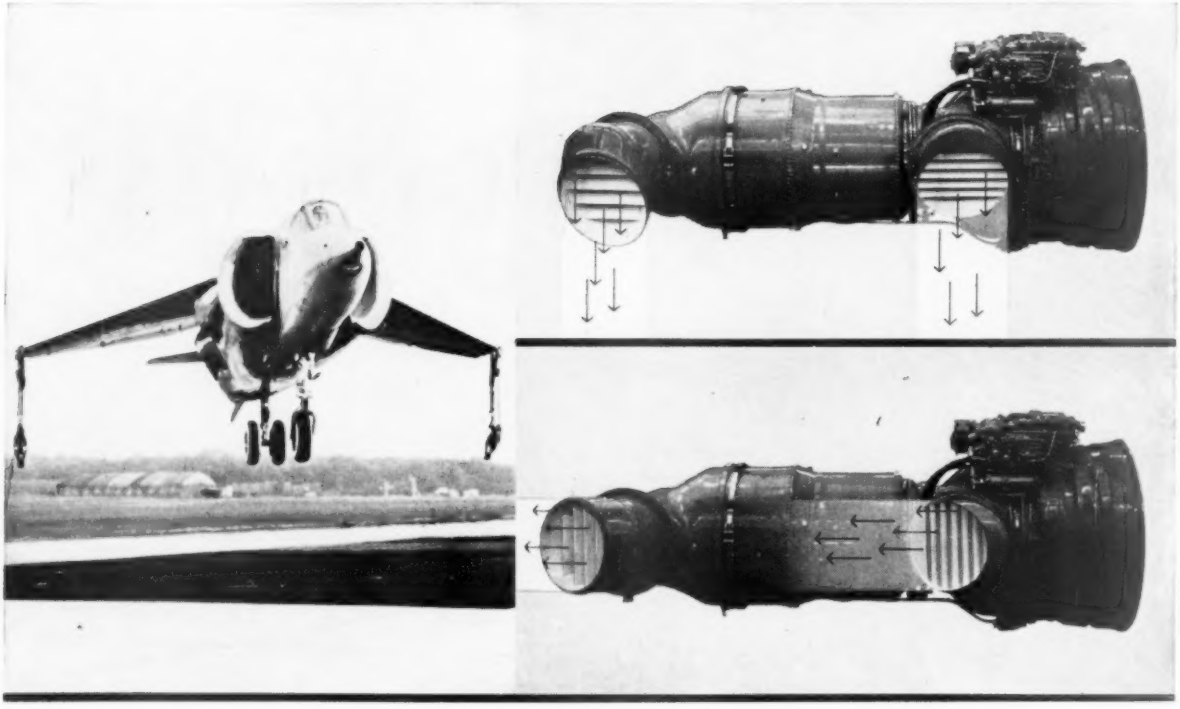
DARCHEM ENGINEERING LTD

BRITISH REFRASIL DIVISION · STILLINGTON · STOCKTON-ON-TEES · CO. DURHAM

A MEMBER OF THE DARLINGTON CHEMICALS LIMITED GROUP OF COMPANIES

BS
AERO POWER

LIFT and THRUST from ONE ENGINE– the revolutionary Pegasus turbofan



The new Bristol Siddeley Pegasus high-ratio turbofan represents a major engineering breakthrough in the field of aircraft propulsion.

Because the Pegasus can be fitted with movable nozzles evenly disposed around the centre of gravity which give directional control to its total thrust, this remarkably versatile engine provides the airframe designer with *a single power source for all conditions of flight.*

VTOL, STOL and normal take-off capability in the same aircraft. Suitable for subsonic or supersonic applications.

High by-pass ratio gives high thrust for low weight, low fuel consumption and low noise level.

Conventional installation. Operational simplicity. Independent of all fixed ground installations.

Problems of ground erosion, recirculation and ingestion of debris reduced to a minimum.

The Bristol Siddeley Pegasus has already been selected for, and is now undergoing trials in the Hawker P 1127 VTOL light strike aircraft and is supported by the Mutual Weapons Development Programme for NATO.

BRISTOL SIDDELEY ENGINES LIMITED TURBOJETS · TURBOFANS · TURBOPROPS · RAMJETS · ROCKET ENGINES
MARINE AND INDUSTRIAL GAS TURBINES · MARINE, RAIL AND INDUSTRIAL DIESEL ENGINES · PISTON ENGINES · PRECISION ENGINEERING PRODUCTS

PEOPLE AT THE SHOW

Photographs copyright "The Aeroplane and Astronautics"

Earl Mountbatten of Burma, Chief of the United Kingdom Defence Staff, watches the flying from the President's enclosure. Second from left is Air Marshal Asghar Khan, C.-in-C. of the Pakistan Air Force; among those in the background are Sir George Gardner, Mr. Eric Turner, Sir Aubrey Burke and Mr. N. E. Rowe.

Above, Col. W. L. Wordon of the U.S.A.F. (left) and Col. F. M. Clarke from NATO.

Below, Mr. Peter Masefield discusses executive aviation with Mr. J. V. Connolly.

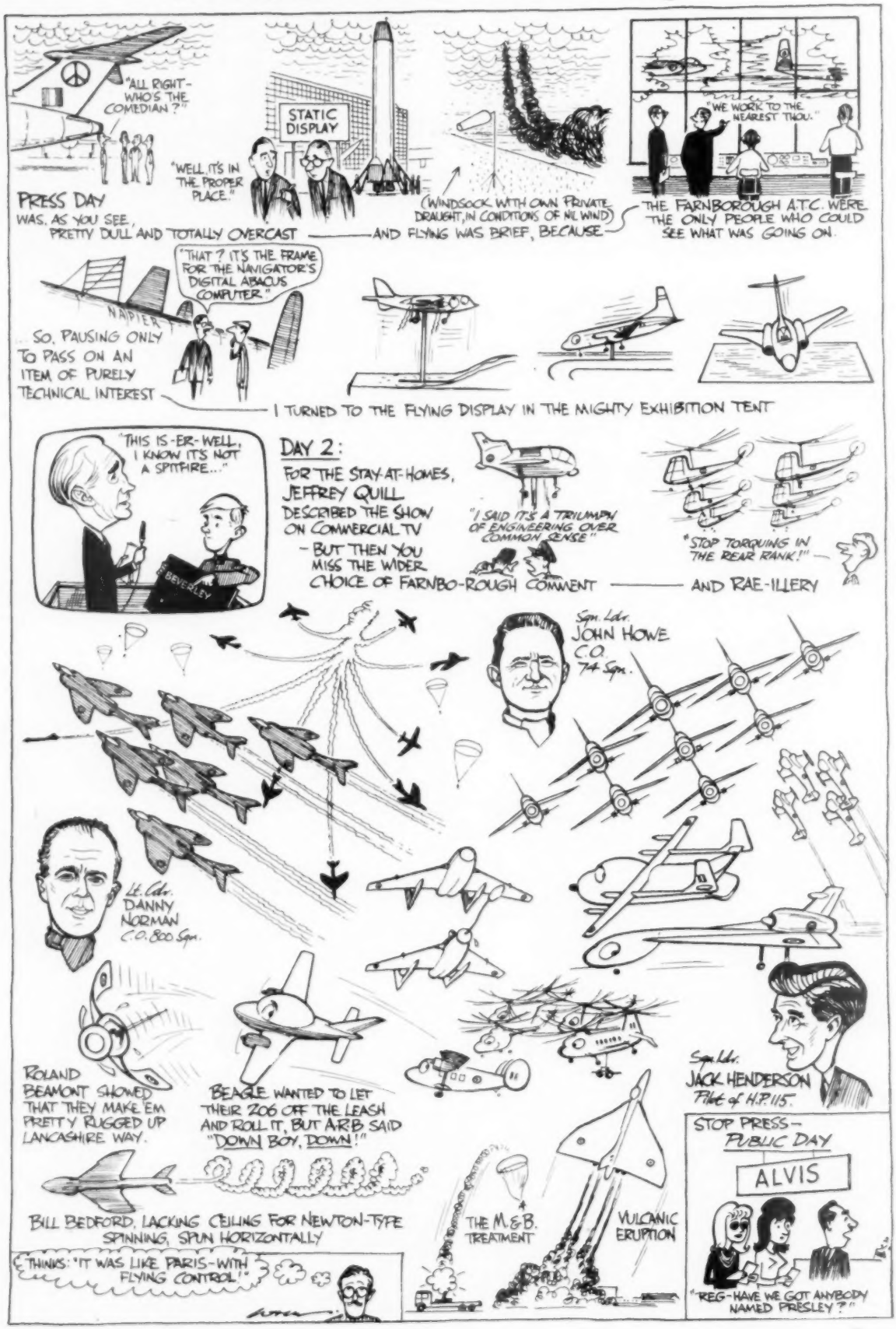
Above, Sergei Ilyushin (second from left) and Oleg Antonov (second from right) were among the Russian guests to be seen with Sergei Leschenko (right) deputy chairman of the Soviet State Committee for Aircraft Production.

Below, left to right, Wg. Cdr. J. H. Walton, C.O. of No. 25 Sqn.; Mr. E. C. O'Brien of Glosters; Sqn. Ldr. E. G. King, of No. 25 Sqn.; Col. E. F. Holck from Denmark; and Maj. J. Bjerre, also from Denmark.

Above, left to right, Mr. Eric Mensforth and Mr. E. C. Wheeldon of Westland Aircraft talk helicopters with Mr. A. H. Milward, of B.E.A.; in the background is Mr. B. S. Shenstone of B.E.A.

Below, Lieut.-Gen. O. Bull, C.-in-C. of the Norwegian Air Force (centre) with Air Vice-Marshal V. S. Bowling (left) and Air Marshal Sir Kenneth Cross (right).

Wroundabout Farnborough


"ALL RIGHT - WHO'S THE COMEDIAN?"
STATIC DISPLAY
"WELL, IT'S IN THE PROPER PLACE."
(WINDSOCK WITH OWN PRIVATE DRAUGHT, IN CONDITIONS OF NIL WIND)
"WE WORK TO THE NEAREST THOU."
PRESS DAY WAS, AS YOU SEE, PRETTY DULL AND TOTALLY OVERCAST
AND FLYING WAS BRIEF, BECAUSE
THE FARNBOROUGH A.T.C. WERE THE ONLY PEOPLE WHO COULD SEE WHAT WAS GOING ON.
"THAT? IT'S THE FRAME FOR THE NAVIGATOR'S DIGITAL ABACUS COMPUTER."
NAPIER
... SO, PAUSING ONLY TO PASS ON AN ITEM OF PURELY TECHNICAL INTEREST
I TURNED TO THE FLYING DISPLAY IN THE MIGHTY EXHIBITION TENT
"THIS IS-ER-WELL, I KNOW IT'S NOT A SPITFIRE..."
BEVERLEY
DAY 2:
FOR THE STAY-AT-HOMES, JEFFREY QUILL DESCRIBED THE SHOW ON COMMERCIAL TV
- BUT THEN YOU MISS THE WIDER CHOICE OF FARNBO-ROUGH COMMENT
"I SAID IT'S A TRIUMPH OF ENGINEERING OVER COMMON SENSE"
"STOP TORQUING IN THE REAR RANK!"
AND RAE-ILLERY
Sqn. Ldr. JOHN HOWE C.O. 74 Sqn.
Lt. Cdr. DANNY NORMAN C.O. 800 Sqn.
Sqn. Ldr. JACK HENDERSON Pilot of H.P.115.
ROLAND BEAMONT SHOWED THAT THEY MAKE 'EM PRETTY RUGGED UP LANCASHIRE WAY.
BEAGLE WANTED TO LET THEIR 206 OFF THE LEASH AND ROLL IT, BUT A.R.B. SAID "DOWN BOY, DOWN!"
BILL BEDFORD, LACKING CEILING FOR NEWTON-TYPE SPINNING, SPUN HORIZONTALLY
THINKS: "IT WAS LIKE PARIS - WITH FLYING CONTROL!"
THE M. & B. TREATMENT
VULCANIC ERUPTION
STOP PRESS - PUBLIC DAY
ALVIS
"REG - HAVE WE GOT ANYBODY NAMED PRESLEY?"

Second Show Report . . . .

Farnborough Flashes

In the Groove

One of the principal talking points during the flying displays, was the new surface given to Farnborough's 10,000-ft. runway by T. C. Stewart (Contractors), Ltd., of Bury St. Edmunds. The ¼-in. wide grooves cut ½-in. deep and 1 in. apart, all over the 870,000 sq. ft. of runway surface by a Clipper Consawmatic machine are reckoned to add an effective 10% to the available runway length by reason of the better braking obtained.

From the Black Sheds to Laffan's Plain

A noticeable feature of the H.P.115 on the ground was its take-off run which appeared to take full advantage of the long Farnborough runway and—so one observer thought—the "hidden 10%" as well.

Non-laminar Supersonics

It was interesting to note that the H.P.115 wing was not flush riveted. The only part of the surface that matters, so far as vortex lift is concerned, is the leading edge portion—and this, it was noticed, was clearly capable of being easily changed for the investigation of different section shapes in that area.

Electronic Contributions

Last year, the total export of capital goods from Britain's electronics industry amounted to some £29 million. Of this, about £15 million came from aviation electronic equipment sales.

Cynical Streak

A senior aeronautical engineer, looking up at Blue Streak was heard to remark: "How nice it is to see that, at last, we've built a missile big enough to need a red light on top."

Midas for VC10

B.A.C. have ordered three Midas CMM/400/7S/60 flight and maintenance recorders for use in the VC10. The manufacturers of the equipment, Royston Instruments, Ltd., state that this is the first order for an ejector-type recorder which can be released from an aircraft in the event of a serious emergency. The recorder is fitted with various recovery aids, including flotation, a homing beacon and marker dye.

Doppler Orders

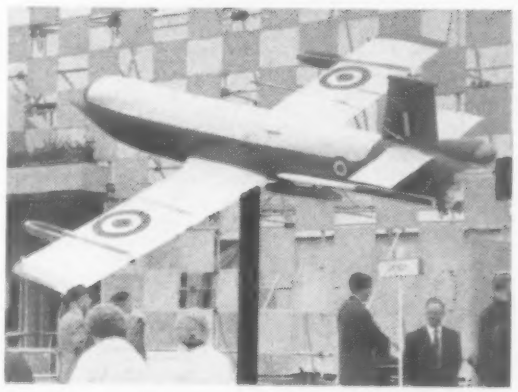
Canadian Marconi have now delivered more than 200 of their CMA-623 Doppler sensors and associated navigation computers to airline operators. Air France now have a total of 30 installations. The Canadian company are planning to start production shortly of a new KU-band antenna and modified transmitter/receiver unit for use with their existing military Doppler system.

Comet Hours

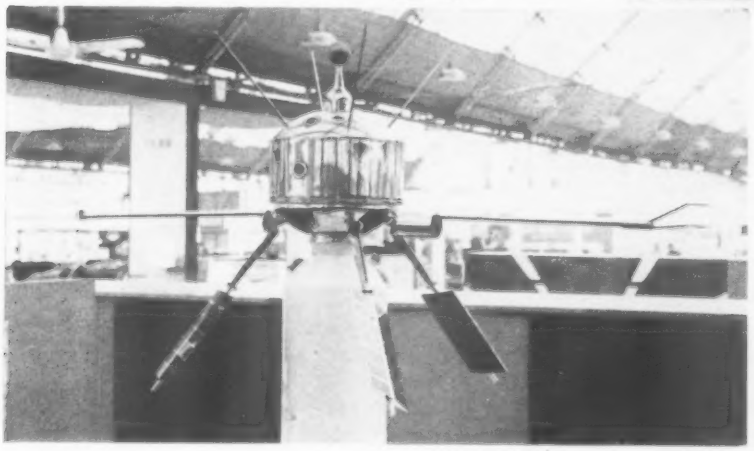
At Aug. 1 last, 53 de Havilland Comet 4s in service had completed 201,357 hours of flying. Highest individual total was 8,050 hours by G-APDC, a B.O.A.C. Series 4. Aerolineas Argentinas had one aircraft (LV-AHN) over 6,000 hr. and B.E.A. had two 4Bs (G-APMB and 'PMC) over 3,000 hr.

Above, not a satellite second-stage for the H.P.115, but ground protection for its vulnerable extended pitot head.

Left, a Consawmatic concrete saw, by the Clipper Manufacturing company, of the type used to groove the Farnborough runway.



Left, the Jindivik 2B, as supplied to the Ministry of Aviation by Fairey Engineering, was exhibited at Farnborough with heat sources on the rear fuselage and a radar reflector over the tail pipe.



An attractive exhibit on the British Aircraft Corporation stand was this half-scale model of the S51 satellite which will take British instruments into orbit from a Scout launch vehicle.

Freight Door

Vickers are designing a large forward freight door for the VC10. It would be applied to mixed passenger/freight versions of the aircraft, in which some operators are interested.

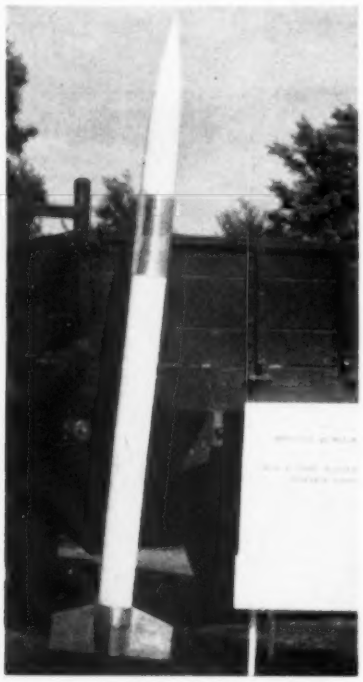
False Alarm

On the Tuesday, Martin-Baker's demonstration of zero-zero runway ejection with a dummy, unfortunately preceded its announcement by Oliver Stewart. As a result, one guest, observing keenly through his binoculars, informed those around him that the "parachutist" appeared to have been hurt—"He's lying awfully still—jolly bad luck."

Second Show Report . . . .

For Fatigue Testing

Electronic Vibrators were showing a completely new design of electro-magnetic vibrator for fatigue testing. This can be operated resonance-free over a range of 5-4,500-plus c.p.s. and has a useful frequency range in excess of 10,000 c.p.s. It has been designed to deal with one of the problems of fatigue testing by electro-magnetic vibrations—that of the resonances created in the vibrator itself.



Bristol Aerojet's meteorological research rocket which has an overall length of 7.5 ft. and weighs 81 lb.

Doppler Drift Unit

On the Ekco stand was a transistorized drift-measuring unit which can be installed as an optional extra with the Ekco E.190 airborne weather radar as an aid to navigation. Measuring aircraft drift angle by Doppler techniques, this unit is employed to move the radar scanner sideways until a video display shows that the indicated deflection angle is equal to the drift.

Gnat Armament

The pre-production Gnat Trainer XM 693 was shown at Farnborough with the wide range of offensive armament which it can carry both for instructional or operational rôles. The Gnat has four underwing attachment points for external stores, and with two of these occupied by 62-gal. drop tanks, can still carry two 500-lb. bombs or corresponding loads on the remaining pylons. To these can be attached two Bullpup ASMs, two 35-tube Thomas French/Matra 68-mm. rocket pods, two Sidewinder AAMs, eight 3-in. RPs with 60-lb. heads, 12 x 3-in., RPs with 25-lb. heads, or eight T.10 RPs. Two camera pods for tactical recce may also be carried, plus tanks, or twin pods with two 0.5-in. Browning guns each, or single 30-mm. ADEN cannon. Without drop tanks, the Gnat can carry two 1,000-lb. bombs, or up to 18 x 3-in. RPs.

Air/Sea Rescue

A new all-transistor miniature radio beacon has been added to the Ultra Electronics range of air/sea rescue communication equipment. Radiating an omni-directional signal on 243 Mc/s, the beacon also has an optional two-way speech facility. Total weight of system, with speech facility, is 46 oz.; without speech the weight is 36 oz.

Supersonic Engine

A diagram on the Bristol Siddeley stand showed that the company favours an unreheated turbojet (Olympus derivative) for Mach 2 operation, and a duct-burning turbofan (Pegasus derivative) for Mach 3. The turboramjet engine is recommended for speeds above Mach 4.

Central Warning System

Rank Cintel have developed a central flight-deck warning system which employs a tri-colour cathode-ray tube divided into three equal segments of red, amber and green to provide colour-coding of aircraft and engine faults. By the use of transistor electronic waveform generation techniques, a failure condition is written on the face of the 4-in.-square indicator tube in the correct colour code zone.

Closed-circuit TV

The Electronics Division of Murphy Radio were showing a new closed-circuit television camera and monitor. The camera, which has automatic sensitivity control, will operate into any standard 405-line TV receiver.

Viper Application

Bristol Siddeley's Viper 20, derived from the Viper 11 with a zero stage, has been specified for one version of the Piaggio-Douglas PD-808 executive twin.

Avro Flights

The two prototypes of the Avro 748 (G-APZV and G-ARAY) have flown about 900 hr., most of this being on the second aircraft. The first production 748 (G-ARMV) is actually the seventh airframe built—two others are test specimens and two were destroyed before completion in a factory fire.

Airborne Audio Warning

On behalf of the R.A.F. Institute of Aviation Medicine, Ferranti have introduced a transistorized audio warning device which can be used to provide immediate speech warning of faults monitored by a central aircraft warning system. Warning messages are recorded on a closed loop of magnetic tape and are designated "priority" or "common" respectively. Signals are repeated three or more times until manually cancelled by the pilot.

H.P.115 Progress

Up to Sept. 2, the H.P.115 had made six flights, including its delivery from Bedford to Farnborough. Three more flights were made at Farnborough on Sunday, Sept. 3, so the first public flight on Sept. 5 was the 10th since the aircraft first flew on Aug. 17.

Visual Flight Simulator Orders

"Substantial" contracts for General Precision Systems' visual flight simulator attachments have been placed by British European Airways for their Viscount and Vanguard simulators and by the M.o.A. for all types of flight simulator in service with the R.A.F. and the Ministry. The G.P.S. visual flight attachment, known as Terravision, presents a dynamic picture of the airfield during take-off and landing (see our issue of Jan. 20, p. 71).

New Radar Simulator

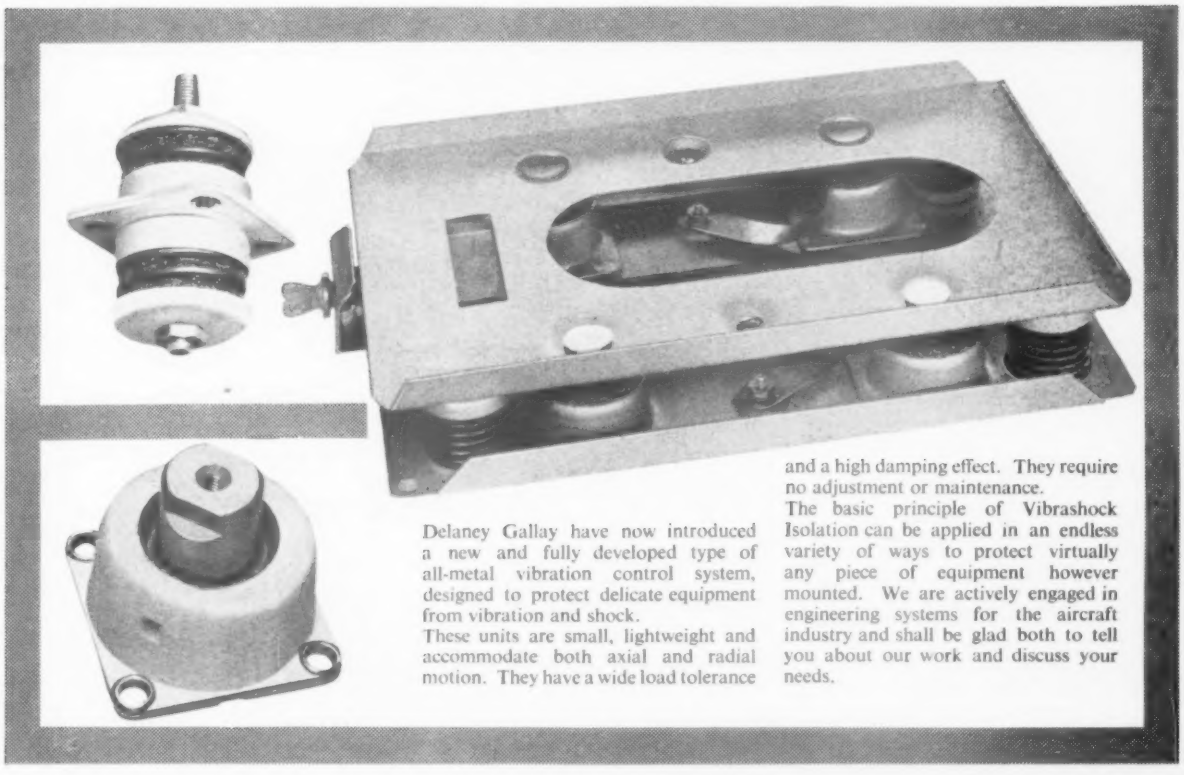
Solartron announced their transistorized three-dimensional radar simulator for A.T.C. training. The simulator, which is based on analogue computer techniques, can be arranged to work with existing PPI displays, either locking to live radar or displaying synthetic echoes.

Prominent on the Sperry stand was their Twin Gyro Platform for inertial navigation systems. It was being seen at Farnborough for the first time.

NEW from Delaney Gallay

ALL METAL VIBRASHOCK ISOLATION

Vibration and Shock Control Systems

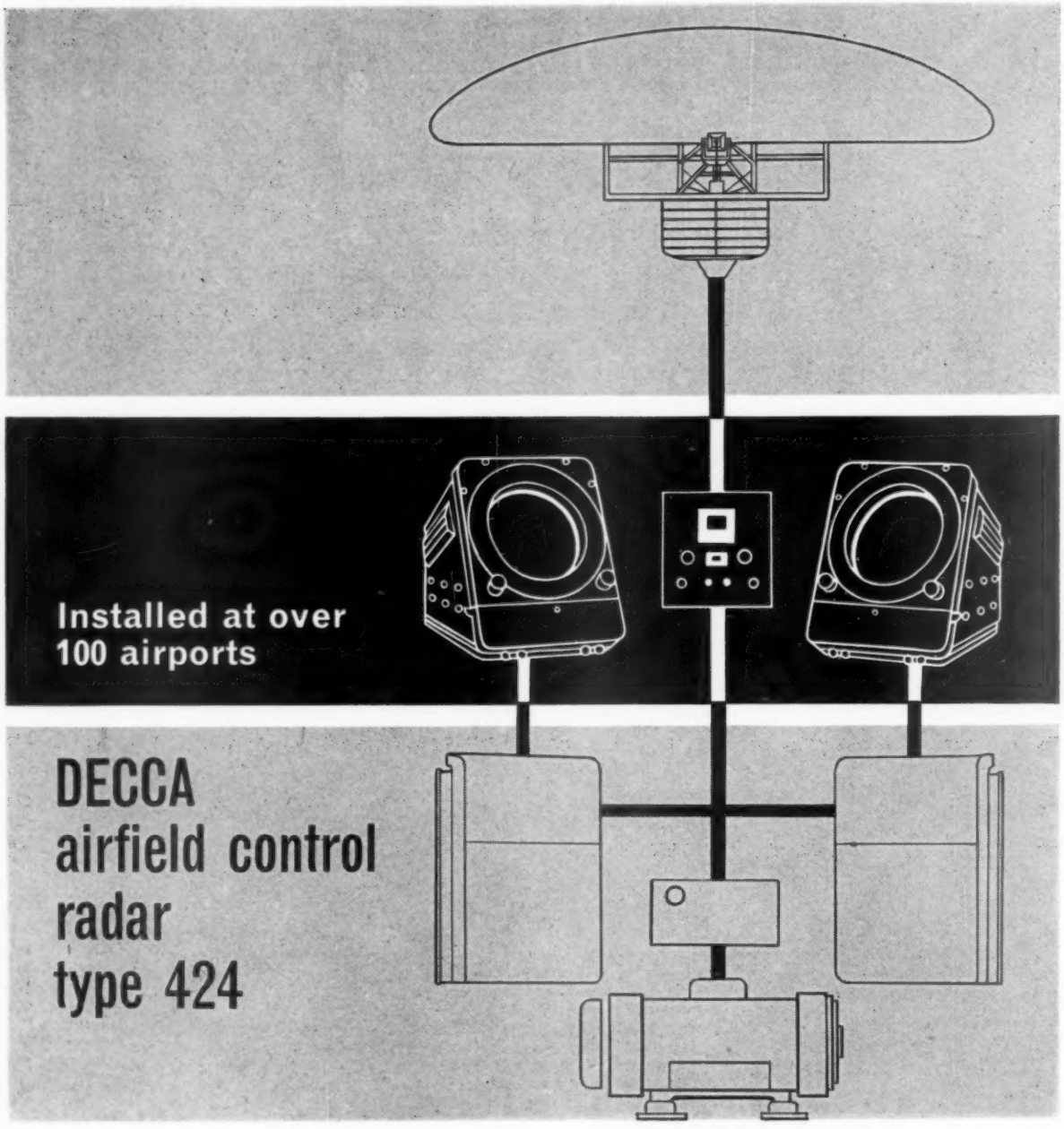


Delaney Gallay have now introduced a new and fully developed type of all-metal vibration control system, designed to protect delicate equipment from vibration and shock.
These units are small, lightweight and accommodate both axial and radial motion. They have a wide load tolerance and a high damping effect. They require no adjustment or maintenance.
The basic principle of Vibrashock Isolation can be applied in an endless variety of ways to protect virtually any piece of equipment however mounted. We are actively engaged in engineering systems for the aircraft industry and shall be glad both to tell you about our work and discuss your needs.

Vibrashock Isolation units are available in standard sizes and types and data sheets can be supplied on request. We strongly recommend, however, that you should consult us at the earliest possible stage of your project so that we can design a complete system for the equipment you wish to protect, since it is only in this way that maximum advantage can be taken of Vibrashock Isolation's remarkable properties.

Delaney Gallay LTD

Vulcan Works, Edgware Road,
London, N.W.2.
Telephone: GLAdstone 2201



Installed at over 100 airports

DECCA airfield control radar type 424

The Decca Type 424 Radar—the simplest and most straightforward of all radar landing aids—is highly efficient, accurate, easy to operate and maintain, and is exceptionally reliable. It has the following outstanding features:—

- Twin channel for full and immediate stand-by.
- Unimpaired performance in bad weather.
- Instantaneous multi-runway coverage.
- High landing rate.
- Proved remote control of all functions.
- Low capital and operating cost.
- Straightforward to operate and maintain.

The widespread use of 424 Radar at airports of all sizes is a measure of the confidence placed in it by civil and military authorities throughout the world.

DECCA RADAR

DECCA RADAR LIMITED LONDON ENGLAND

DR 169

Second Show Report . . . .

Safety and Systems

AIRCREW survival was a prominent theme of this year's S.B.A.C. Show programme, in which for the first time there were daily demonstrations of an actual ejection. This was performed at zero-height and zero-speed from a lorry in the middle of the airfield, with the Martin-Baker rocket-assisted VTOL seat, which approaches the ultimate in escape aids of this kind. Apart from the clean separation and soaring 350-ft. trajectory of this demonstration its most impressive features were the confidence displayed by its routine daily operation, and the consistency of its performance.

Although the zero-zero demonstrations were undertaken with a representative dummy load, two live test ejections have been made with this new seat by Flt. Lt. W. T. H. Hay. It incorporates the experience gained by the production of nearly 16,000 ejection-seats by the Martin-Baker company, which can claim over 460 lives saved by its products.

Inside the static show, Martin-Baker exhibited a Mk. 4 MSA production seat for the Blackburn Buccaneer, and a Mk. H.5 unit for the McDonnell F4H Phantom of the U.S. Navy. The Buccaneer seat is designed for canopy penetration as the standard escape technique, and has extensions above the head rest and thigh guards to protect the pilot from injury. The thigh guard penetrators serve also to reduce a tilt tendency should the forward part of the seat strike an unshattered part of the canopy during penetration. The extended side valances permit in addition an improved stowage of the leg restraining linkage.

The Buccaneer seat is otherwise similar to the standard Mk. 4 unit, with the usual features of personal equipment quick-connect, electric seat-height adjustment, emergency oxygen system, and horseshoe-shaped canopy pack. The McDonnell Phantom seat, which may be used for ejection at speeds considerably above Mach 2, is generally similar to the Mk. 4 unit except, like all the Mk. 5 series for American aircraft, its structure is stiffened to meet the the 40 g crash case.

Like all current Martin-Baker seats, it also has the simplified manual override system, incorporating a cartridge-fired guillotine to sever the link-line between seat and parachute. Actuation of the manual override also disconnects the combined harness attachment to the seat structure.

Since it was shown last year, the Folland Mk. 4 GT light-weight automatic ejection-seat for the Gnat Trainer has been given full runway capability, down to 90 knots, and photographs were shown at Farnborough, alongside the actual hardware, of this being achieved from a Meteor 7 at Dunsfold. The Mk. 4 GT seat retains the combined seat-frame and 80-ft./sec. telescopic ejection gun of the earlier units, but has a small extractor parachute which is fired out by an explosive slug immediately after ejection below 300 knots, to initiate rapid deployment of the drogue sock, stabilizer and main canopy of the pilot's parachute.

Folland Seat Ejection Trials

Ejection trials with the Folland seat have recently been completed up to 645 knots on the R.A.E.'s rocket-sled at Pendine, and many dummy ejections have been conducted from above 40,000 ft. from a Meteor to clear the man-stabilizing system. Folland are continuing development of the basic seat with rocket boost augmentation for zero capability.

The three-stage stabilization system for the Mk. 4 GT seat was shown in detail by the G.Q. Parachute company, by whom it is being built for Folland. Initial stabilization is by a 30-in. drogue, which has a central compartment containing the main system. A larger stabilizer is exposed by the G.Q. releasable swivel mechanism, allowing the third and biggest drogue to deploy. At 10,000 ft., the G.Q. Auto-Rip Mk. 7B stowed within the main parachute pack operates barometrically, releases the shoulder-attachment of the stabilizing system, which then withdraws the pilot's canopy.

An aircrew escape aid of a slightly different nature was shown by M.L. Aviation. Intended primarily for the three rear crew members of the V-bombers, who are not provided with ejection seats, the M.L. special static seat is designed to assist them to their feet against the effect of high *g* forces, and so enable them to abandon the aircraft through the escape hatch.

The M.L. seat has a built-in back-type parachute, with a simple quick-attachment to the aircrewman's harness. This permits the parachute to be dispensed with throughout most of the flight, to simplify movements in the congested rear cabin.

To actuate the seat, its occupant pulls initially at a handle on its side, thus bringing forward the parachute lift webs for harness attachment. The parachute is also detached from the seat, and the head-rest retracted for easier movement. Further pressure on the handle releases more compressed air into an inflatable bag in the seat pan, thereby pushing the occupant to his feet, and to one side or other of the seat.

Developed in conjunction with the R.A.E., the M.L. inflatable seat has not yet been operationally tested, but incorporates all the normal adjustment features of the rearward-facing V-bomber seats. Also shown by the M.L. company were the Type 12P Mk. 3 partial pressure helmet, barometrically controlled for auto-closing; a blast shield and sun visor for protective helmets; and ejector release units.

Irving Air Chute showed tail braking parachute assemblies for a couple of high-speed aircraft. These comprised the LB2 Mk. 2, a 16 ft.-diameter hem-rigged canopy for all marks of Lightning, and the LB4/1 parachute for the supersonic Bristol 188. The LB4/1 is of Terylene, with a specially treated nylon pack for resisting the effects of thermodynamic heating.

Systems of Interest

Among the systems of interest at Farnborough, were representative power controls from several civil and military aircraft, displayed by Boulton Paul Aircraft, Ltd. These included an aileron powered flying control unit and a variable tailplane unit for the Blackburn Buccaneer, both with provision for mechanical or electric signalling. The former comes from stick position, and the latter, from the autostabilizing unit. An aileron unit from the Valiant had provision for manual reversion, differing from that of the Vickers VC10.

Eleven powered flying control units are incorporated in the VC10, four for the ailerons, four for the elevators and three for the rudder. The units are fully powered and their arrangement is such that each operates independently a portion of the split control surface. In addition, there are 12 spoiler jacks, arranged in pairs for each section, and also supplied by Boulton Paul. The spoilers have a dual function; they can be extended on each wing to act as airbrakes, or they can be operated from the aileron controls to augment aileron power. Actuation of all the "packaged" Boulton Paul units, including those for the Short Belfast and the Bristol 188, is hydraulic.

Dowty showed a range of servo actuators for power controls, using electrical, electrical and mechanical, and automatic manual reversion signals. The last-mentioned is a position-controlled servo unit which amplifies the input force by a fixed ratio via hydraulic pressure.

A typical installation is on a control system where the booster unit is installed between the control column and the surface. The unit reverts to a mechanical strut without backlash in the case of hydraulic failure and a by-pass valve is incorporated which allows the piston to be stroked manually. The unit is leak-stabilized through an orifice which is an integral part of the by-pass valve assembly. Provision is made to break out a jammed servo via a ball detent trip mechanism.

A dual input servo valve, which controls twin actuators, incorporates hydraulic power duplication and is designed for use in fully powered flying control systems. Another Dowty unit is an electrically signalled hydraulic actuator suitable for differentially applying mechanical input signals to a power-operated flying control system.

Of particular interest were the Dowty range of ram air turbines, for supplying stand-by electrical and hydraulic power in the event of failure of the main source. They provide an entirely independent power source for driving alternators, generators, hydraulic pumps, air compressors and so on.

The turbine is a single-stage axial-flow design comprising two or more turbine blades, with automatic variable-pitch control from a built-in speed-sensitive governor system. The example shown was a large unit which will be one of two for the VC10. At a governed speed of 8,000 r.p.m., it will deliver an hydraulic pressure of 3,000 p.s.i., or a power output of 15 kVA. at 0.7 P.F. Weight is 23½ lb.

Among the control units shown by Fairey Engineering were hydraulic mechanisms for a variety of British and foreign civil and military types. These included Scimitar aileron and tail-plane servos, a flap interconnect control for the Hunting 126 jet-flap research aircraft, and an elevator power control, with manual reversion, for the Hindustan HF 24 jet fighter.

A significant exhibit connected with the Bristol Belvedere helicopter comprised components for a fully duplicated power control system incorporating special safety features to meet civil aircraft requirements.

Second Show Report . . . .

Cabin Equipment

IN these days of intense competition in air travel the comfort and well-being of the passenger is placed high on the priority list by airlines and cabin equipment manufacturers alike. Below are highlighted some of the new developments in seating, personal oxygen equipment and galley equipment as seen at this year's Show.

From a "tour" of the seat manufacturers stands it was interesting to see the varying approaches to the basic problem of providing great comfort with weight and space at a premium.

Starting with the economy class, Microcell showed its latest conception for mass air travel, the Double Travellite Mk. 2 seat. This weighs 35.7 lb., has a recline of 15-30° within seat pitches of 29-36 in., and bears a family likeness to the company's first-class and executive seats, also shown.

Rumbold, too, had a new high-density tourist seat on show, the first of a new range being developed by the company to meet modern close-pitch arrangements. The non-recline version weighs 38 lb. as a double seat and another 14 lb. when it is in triple form. Reclining double- and triple-seat units weigh 40 lb. and 56½ lb. respectively.

This type of seat has the usual tip-up cushion, fold down back and indexing legs to suit varying seat-unit pitches. The actual unit on show was a triple seat for Ghana Airways to be installed in its Viscounts. Another seat for this airline was a luxury unit to be supplied as part of a V.I.P. kit also for Viscount installation.

An entirely new seat shown by Lancefield Aircraft Components, in both its double and triple forms, has been developed as the result of the company's belief that one seat can fulfil both tourist and semi-first-class applications. This is classed as a luxury tourist seat, upholstery style being adjustable for tourist or first-class requirements. Its features include a press-button three-position back rest with adjustable forward brake and recline angles of 22°, 30° and 38°.

Flight Equipment, the company which reseated B.E.A.'s Viscount fleet, is currently engaged on fitting the Corporation's Vanguards with seats as they prepare to enter service. It was only to be expected that this company featured seats for the latter type of aircraft prominently on its stand. Both the triple first-class and tourist units were shown.

Seats were also displayed by Short Bros. and Harland. In the outside display site was a fuselage section of the proposed SC.5/31, civil version of the Belfast. On the upper deck of this, formed by a removable pallet, were shown four rows of the company's Type 260 seat which has just been ordered for the R.A.F. Transport Command's Argosys.

Although one is now getting used to the idea of emergency liquid oxygen supply systems in aircraft it is not such a great while since their development first got under way and consequently a lot of new work is still being undertaken. To illustrate this one can pick out the test rig for the Argosy's Lox system shown by British Oxygen as the centrepiece of its indoor stand. This has been built by Armstrong Whitworth in collaboration with B.O.C. to develop the 25-litre Lox converter package units which form the basis of the system, and are now in full production for both the Argosy and Comet 4Cs for Transport Command.

On the test rig itself six Argosy crew members were simulated by B.O.C. Beaver breathing machines. Coupled to the six crew regulators were four meters and gauges for testing the adequacy of the Lox supply for each crew member.

Also shown by British Oxygen was its latest oxygen supply system for light and executive aircraft. From this portable unit, weighing only 25 lb., enough oxygen for six persons cruising at 15,000 ft. can be supplied for something like two hours.

The other two big names in this sphere of operations, Normalair and Walter Kidde, have the Lox system for the

Above, tableware in Perspex for cabin use was shown by B. Attewell and Sons. Seen here are glasses in their carrying trays for B.E.A.

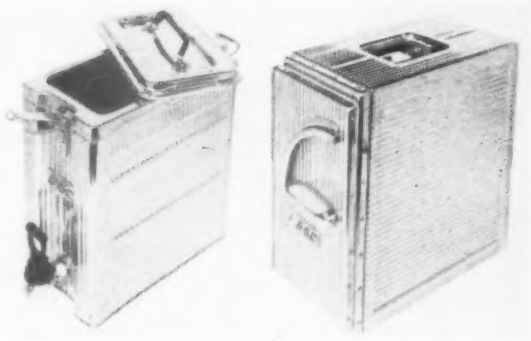
Left, test rig for the Argosy's liquid oxygen breathing system displayed by British Oxygen.

Photographs copyright "The Aeroplane and Astronautics"

VC10 as their immediate chief concern and showed equipment in relation to this. On the Normalair stand was the 35-litre Lox converter and details of the complete system including the reserved circuit for the flight deck. Walter Kidde showed the type of face mask which will appear before the passenger's eyes should a pressurization failure occur; also shown was the mask developed for the Trident's gaseous oxygen system.

Almost invariably the sole exhibitor of galley equipment—and so far as one could see, again so this year—G.E.C. were showing two new items. These were an international size hot cupboard and a beverage container; both are made in "rigidized" stainless steel to enable them to withstand the severe handling to which this type of equipment is subjected. The interiors are also of stainless steel. Earlier models, of which examples for Olympic Airways, B.E.A. and the R.C.A.F. were also on display, have had an outer casing of aluminium.

During the Show it was announced that B.E.A. had ordered a quantity of the new units. These are for use on the D.H.121 Trident and, we understand, the Corporation intends to use them as standard in other aircraft of its fleet.



Stainless-steel galley equipment—a beverage container and a hot cupboard—by G.E.C.

Developments in Ground Equipment

GROUND equipment for a variety of uses was well in evidence again this year. A large part of the outside display park was devoted to products in this category which were also to be found in quantity on a number of stands in the exhibition tent itself. Here are described just a few of the new items in this field which were seen at the 1961 Farnborough Show.

Two years ago, in our report of the Farnborough Show, we described new developments in the Zwicky range of aircraft fuellers. This year from the same company there were more developments to be seen and although they may not have been as sizeable as those of 1959 they were none the less important.

The first is a new hose-end filter of advanced design used at the delivery end of the refuelling hose to trap and remove foreign matter from the fuel flow. At any time during operation the filter element can be examined through four Perspex-lined points. During tests at high flow rates and pressures up to 250 p.s.i., no filter element distortion has taken place.

The prototype unit of a new in-line pressure controller for hose-end fitting was also to be found on the Zwicky stand. This, with a ½-sec. shut-off at the delivery valve, will control surge pressure to 62 p.s.i.—only 12 p.s.i. above the nominal setting.

New developments were also to be found on the Avery-Hardoll stand in the form of remote readout equipment and a temperature compensator. The former has been designed to give a clear and concise indication of the number of gallons dispensed by a Bulkmeter by indicating "gallons to go" as well as "gallons gone." The temperature compensator is for fitting to the company's range of Bulkmeters to correct the datum temperature reading to 60°F. Consequently, no temperature recording or correction calculations are required for any metering processes.

Aquascan, the fuel monitoring instrument which detects and measures on a continuous basis undissolved water in turbine fuel, previously described in THE AEROPLANE AND ASTRONAUTICS, was at Farnborough for the first time. It was to be seen in two places—on the stand of its makers, the Thermal Control Co. and fitted to a 3,500-gal. Hertford Mk. III fueller in Air BP colours, one of four fuelling vehicles exhibited by Zwicky in the outside display park.

Also in the distinctive markings of Air BP was the only really new fuelling vehicle at the Show, the Rellumit Ranger

The outside display park with H.M.L. and Airtech exhibits in the left foreground. Tallest exhibit again this year was by Dexion whose approach lighting tower built up in slotted angle reached 55 ft.

Another view of the outside display showing a large part of the oxygen storage and handling equipment exhibited by British Oxygen. On the right is the back of the civil Belfast fuselage section.

hydrant dispenser. Based on a Karrier Gamecock 11-ft. 9-in. wheelbase this has a laden overall height of 5 ft. 6 in. Rated flow is 600 Imp.gal.p.m. through two upper-deck hoses or 400 g.p.m. through reel hoses.

For some time aircraft handlers produced by M.L. Aviation have been in use with the Royal Navy as a means of moving aircraft on carrier flight decks. These have a 10-h.p. power unit which produces a maximum tractive effort in the order of 2,600 lb. This year at Farnborough M.L. were able to show the first production unit of a new model developed for the Navy.

Power unit size has been enlarged to 26 h.p. and the tractive effort increased to 6,500 lb. with the result that a typical performance claimed for this new unit is the movement of an aircraft weighing 50,000 lb. up a 3° incline at 1 m.p.h. or on level ground at 3½ m.p.h.

One of this year's new exhibitors was Didsbury Engineering, manufacturers of the Minilift aircraft and missile hoist servicing system. This consists simply of a winding mechanism to which can be added a variety of attachments providing for any combination of lifting problems. Four manually operated hoists with capacities of 2½, 5, 10 and 25 cwt. were on show.

With exception of a single item Morfax devoted their outside display to servicing and transportable engine stands for Rolls-Royce turbine engines. Most interesting of these was a hydraulic elevating platform for vertical strip/build of large gas turbines, shown with an Avon in position. The 10-ft. square hydraulically operated platform enables servicing teams to operate on and below the platform simultaneously. Interchangeable shroud plates allow various engines to be serviced.

Another interesting item on show was the DA 6590 hydraulic dynamometer, capable of absorbing and measuring up to 10,000 b.h.p. at speeds from 3,750 to 10,000 r.p.m., shown by Heenan and Froude. This has been specially designed for the testing of gas turbines and other prime movers developing both high powers and high speed. It is available in a number of sizes, the range extending from a machine capable of measuring 350 b.h.p. at speeds between 17,500 and 45,000 r.p.m. to one rated for 25,000 at 2,400-6,500 r.p.m.

British Oxygen devoted a large part of their outdoor display to liquid oxygen servicing and storage developments. One item on show for the first time was a Lox ground servicing half coupling designed to overcome the problem of freezing which occurs within the coupling mechanism. This has been designed to American and Canadian, as well as to British, specifications and can be used in the Lox refuelling systems in all NATO aircraft.

The new device forms a self-sealing end to the charging hose of a Lox dispenser and can be coupled easily and quickly to the aircraft's charging connection. When connected, it automatically opens its own sealing valve and that of the aircraft connection. Operating at pressures up to 50 p.s.i.g. the new coupling prevents freezing within the connection by means of a specially developed gas-bleed.

Also shown by British Oxygen was the company's latest addition to its range of vacuum-insulated evaporators. This, the V.I.E.30, is intended for the small and medium consumers and holds the liquid equivalent of 30,000 cu. ft. of oxygen. It can also be used for liquid nitrogen or liquid argon.

The 10-ft.-high installation consists of a vacuum-insulated vessel, a vaporizer and a control cabinet. It automatically vaporizes and supplies oxygen at a predetermined pipeline pressure, at a flow rate of up to 5,000 cu. ft. per hr., depending on the vaporizer size.

Some significant developments in ground power units have come from Auto Diesels and Houchin. Both companies were showing prototype units completed just in time for the Show.

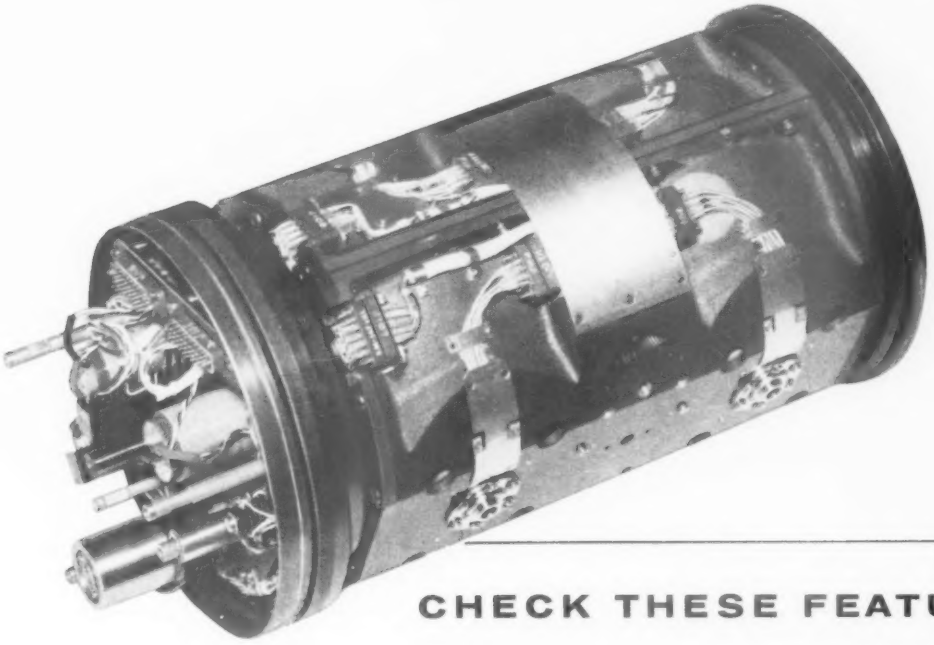
Auto Diesel's contribution was a composite trailer-mounted threefold aircraft starting and servicing unit supplying 60-kVA., 120/208-V., 3-phase, 400-c.p.s., 28- and 112-V. DC supplies. This has been developed by the company for duties at airports where a varying power supply, determined by the type of aircraft being dealt with, is constantly needed.

The two new units shown by Houchin, the "Recti-Cy" and the "Recti-Hy-Cy" were both of a brushless design. The smaller has been developed from the Houchin Mk. III 60-kVA. trolley in the light of experience gained with existing types of DC G.P.U.s fitted with commutators and brushes. Primary source of generation is a 240-c.p.s. AC machine giving a supply of 20-30V., 6-phase, designed to run at 1,800 r.p.m. For ground servicing a continuous output of 700 amps., 28.5 V. ±1% is available. For engine starting there is an intermittent output of 1,500 amps. 28.5 V. with a similar percentage variation.

The larger "Recti-Hy-Cy" with its industrial diesel engine coupled to brushless self-regulating alternators is designed to give outputs of 120/208-V., 3-phase, 400-c.p.s. 4-wire and 30 V., 200-c.p.s. 6-phase, with the prime mover at 1,500 r.p.m. The 400- and 200-c.p.s. supplies are fed into rectifier stacks to give DC supplies.

SPERRY

TWIN-GYRO PLATFORM



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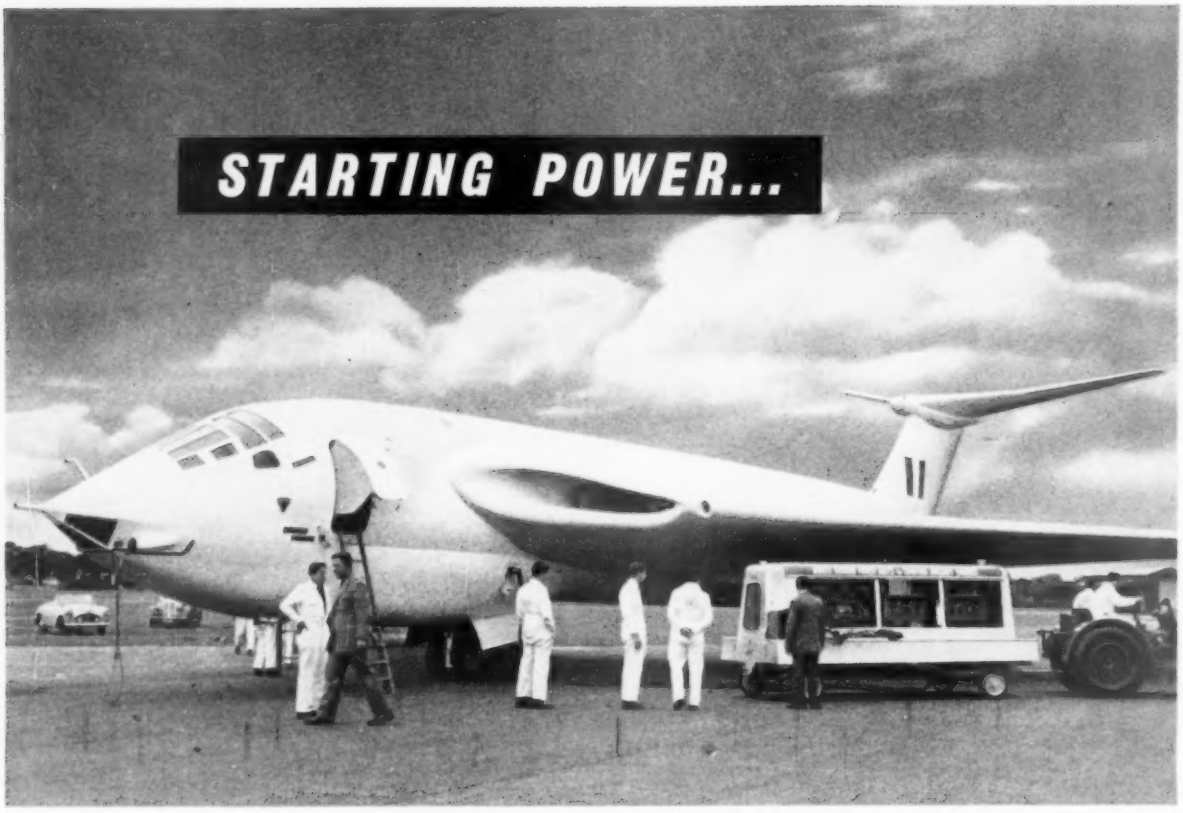

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Second Show Report . . .

Materials and Processes

An interesting example of structural detail for the Bristol 188 was this puddle-welded titanium air intake unit.

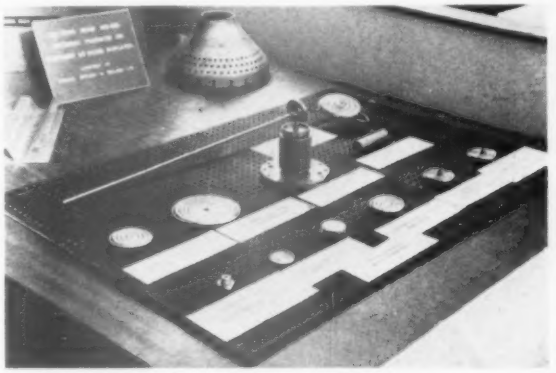
THE emphasis in metals seen at Farnborough this year was down-to-earth rather than exotic. Although there were a few samples of the possible materials for the space exploration era, they are not yet of great practical interest. Accles and Pollock, for instance, showing a range of seamless tubing in such metals as zirconium, tantalum, vanadium, niobium and molybdenum, find that interest in these materials—at the moment mainly centred in nuclear energy applications—is severely damped by their high cost.

Nevertheless the engine makers, with their ever-increasing demands for high-temperature materials, are beginning to venture into the practical exploration of refraction metals. On the Jessop-Saville stand, for example, a pure molybdenum turbine-blade forging was on view as supplied to Bristol Siddeley Engines, Ltd., for experimental purposes. Although heavy—a specific gravity nearly twice that of iron—and difficult from the oxidation standpoint, molybdenum's higher elevated temperature strength, in comparison with the Nimonics, may make it possible to push up operating temperatures by some 150°C.

Special-alloy makers and steel suppliers such as Jessop-Saville, Firth-Brown, Samuel Fox and Co., and the English Steel Corporation, all agree that today the focus is on vacuum-melted materials. The first two of these companies are already well established in the vacuum-melting field.

Samuel Fox, although they have no such facilities themselves, can supply all their products as vacuum melts through I.C.I. Metals, Ltd. And the English Steel Corporation foreseeing that within a few years all rotating parts of jet engines will call for vacuum-melted materials, will have a plant in operation by the end of this year—part of their current £26 million development programme.

The main virtue of casting metals in vacuum—a process developed for the production of the highly reactive metal titanium but now also applied to alloy steels, stainless steels and the nickel-base alloys—is freedom from non-metallic inclusions, giving much better ductility transverse to the grain and lower notch sensitivity. The process also provides better control of chemical composition and, in some alloys, improved mechanical properties. It makes possible some very attractive precision-casting alloys which are tending to outdo the corresponding wrought alloys in mechanical properties.



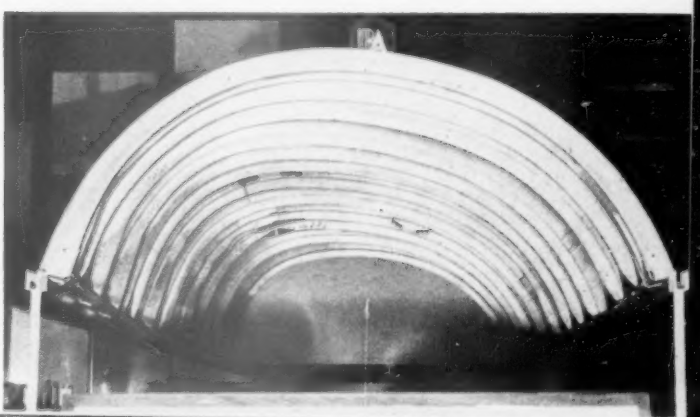
Vacuum-welded components by Sciaky.

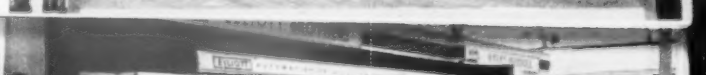
One well-established vacuum-melted precision-casting application is the use of Jessop-Saville's nickel-base Vacumelt G 64 alloy by Bristol Siddeley Engines for the turbine blades of Proteus engines.

Consequent upon the establishment of vacuum melting, the metal industries report increasing interest in ultra-high-strength steel forgings. A new refrigeration-hardening 100-ton steel, D.50, recently introduced by the English Steel Corporation, which can be readily machined in the unhardened condition, is believed to be used in the TRS2, and the British Aircraft

Drop forged components for the Wessex in vacuum-melted steel on the Firth-Derihon stand.

Right, British Aluminium were exhibiting this fine example of two-way stretch-forming; it is a cowling panel for the Conway in aluminium alloy.

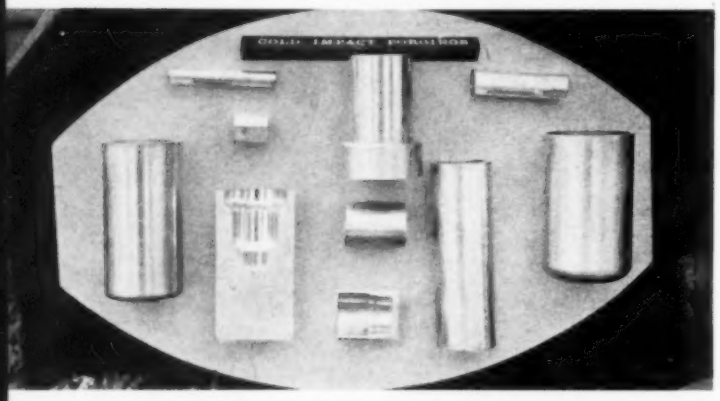




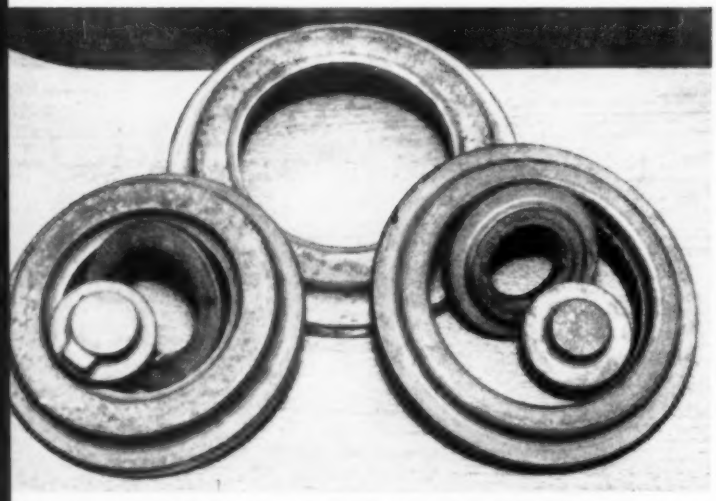
Second Show Report . . . .

Corporation are considering its application for undercarriage forgings in the VC10 airliner.

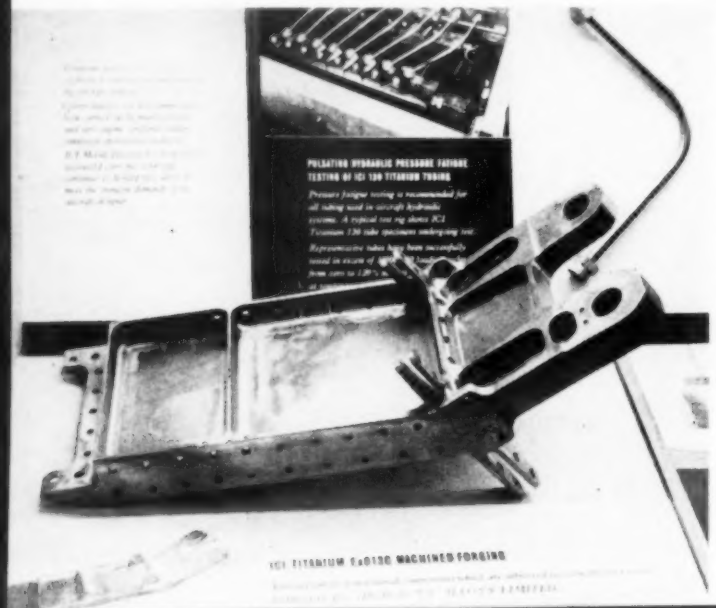
Interest in titanium and its alloys, although by no means approaching that in the U.S.A., is increasing steadily. I.C.I. Metals report a sales growth of approximately 20% per annum. Engine makers are still the main customers for titanium alloys, for such uses as turbine and compressor blades, discs, and by-pass ducting, but there is a growing interest in airframe applications such as bolts, jacks, and forgings of various types. Seen on the I.C.I. stand was a wing-spar forging in their new experimental 80-ton titanium alloy Ex013C, produced by High Duty Alloys for Blackburn Aircraft.



Cold-impact forgings on the High Duty Alloys stand.



Bearing rings as forged, shown by Firth-Derihon; they are for Rolls-Royce engines.



A machined forging in I.C.I.'s titanium alloy Ex013C.

Turning to the aluminium alloys, it is interesting to note that both of the big suppliers to the aircraft industry, Alcan Industries (incorporating Noral), and James Booth (Duralumin), have recently installed new hot-rolling mills, claimed respectively to be the largest in Europe (Alcan) and the largest in the United Kingdom (Booth)!

In fact, Booth, with a 148-in. four-high hot mill, win by 4 in. in width. Sheet and plate of this width is not, in fact, of interest to the aircraft industry, but is a reflection of the increasing use of light alloys in the shipbuilding and constructional industries. The new facilities will, however, make high-quality close-tolerance sheet and plate for the aircraft industry a more economical proposition.

Both these companies are supplying stretch-levelled high-strength aluminium-alloy plate in thicknesses up to 4 in. or more, for integral machining techniques, and they find that the demand for plate for airframe uses is increasing. Most aircraft currently under construction—the Buccaneer, the Trident, the VC10, the B.A.C. One-Eleven and the TSR2—incorporate integrally machined main skins.

The British Aircraft Corporation in particular favour extensive machining from the solid—in the VC10 airliner some 55% of the airframe is hacked out from slab material, including the main cabin side panels embracing window and door cut-outs. The longer and integrally stiffened wing skin, cut from a billet 35 ft. long by 40 in. wide by 2½ in. thick, is milled down to a basic finished skin thickness of 0.165 in. Contouring to profile is carried out after milling, the thicker lands being formed on hydraulic presses and the thinner panel areas by shot-peen-forming.

Details of some of the construction methods of Britain's all-steel supersonic research aircraft, the T.188, were shown by British Aircraft Corporation. Over 90% of the stainless steel used in its construction was made by Firth Vickers Stainless Steel. A technique known as "puddle welding," or Argonarc fusion spot welding, has been developed for use with stainless steels which do not take kindly to ordinary resistance spot welding.

In the puddle-welding process, welding is carried out in an argon atmosphere under a shield, with only a light pressure required on the surface being welded. One of the main advantages is that welds can be accomplished on assemblies accessible from only one side.

Another interesting and unfamiliar use of welded construction could be seen, in photographic reproduction, on the Handley Page stand. Their well-known welded corrugated sandwich light-alloy construction technique is being used for large search-radar aerials—the one depicted measuring some 60 ft. by 20 ft. This, it is claimed, compares very favourably—in terms of cost, and of accuracy both static and under the action of high winds—with reinforced plastics aerials; and there are no problems of delamination.

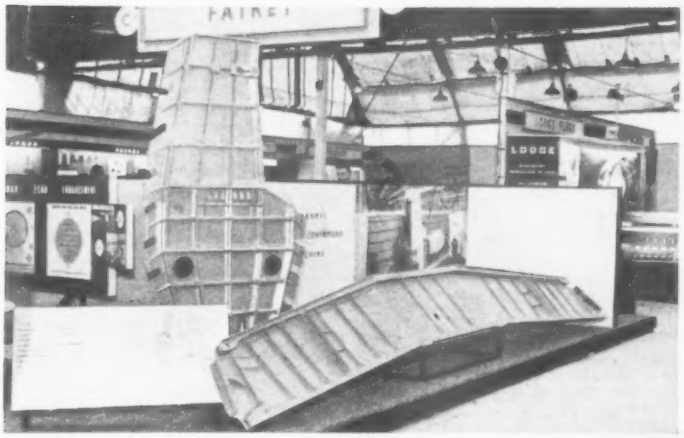
New metal-forming techniques include developments in cold forging. Precision Forgings (formerly the Blade Division of Carringtons) showed examples of their new close-limit cold-forging process applied to steel components. At present their main customers are the motor industry, but the process is arousing interest for the making of dies for gas turbine blades.

High Duty Alloys also showed pieces made by their new cold-impact forging process to limits of accuracy within ±0.0001 in. Shell-type components can be made with walls as thin as 0.01 in.; and internal and external splines with sharp-edged radii can be satisfactorily produced. At present applications of this process are mainly centred in the instrument and electrical installation fields.

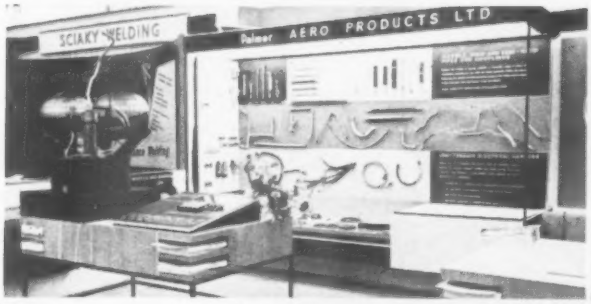
Possibly one of the most interesting developments in the use of materials, discovered in conversation with Rolls-Royce but not overtly displayed on their stand, is that VTOL engines are going over to plastics for many stressed parts, on the score of weight saving and low cost—the latter a very important element in the sales appeal of these engines. The use of reinforced plastics for rotor blades is in fact the key to the 16 : 1 thrust/weight ratio that Rolls-Royce claim to have achieved. Thus the whole weight of the rotating assembly is reduced, which in turn reduces the load on the bearings and their housings, so that the compressor casing too can be made in reinforced plastics, thereby adding more lightness to the engine assembly.—M.N.

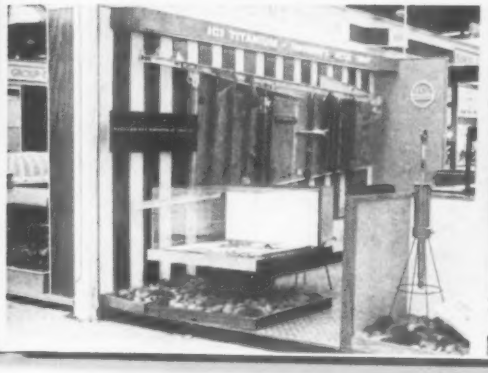
Second Show Report . . . .

Around the Stands



A few of the 300 stands that were set out in the main exhibition marquee to display the specialist wares of the ancillary industry.





ICI TITANIUM RADIUS MACHINED FORGING

Gliding Notes

by Dr. A. E. Slater

AT the Bristol Gliding Club's two-day competition on Sept. 2-3, for which 21 gliders were entered with 30 pilots, neither day was a contest day. But the reason was anticyclonic stability, unlike the reason for an absence of contest days at the four-day Easter meeting in Norfolk, which was cyclonic rain. So everyone could sit around in the smart bit of landscape gardening in front of the club-house, and roast their barbecue steaks there under Saturday night's sky.

Saturday's task was a race to Edgehill and back, but only John Williamson went far enough to score, landing near Cheltenham. Tony Gaze and Ray Brigden also got away. But instability was building up at higher levels, and although no task was set on Sunday, in the evening Peter Philpot and John Firth were towed under a thundery-looking cloud with its base 1,800 ft. above hill-top, and climbed 4,800 and 7,000 ft. respectively.

The previous Sunday would have been much more suitable, for the club chairman, Dennis Corrick, flew on that day to Yarmouth. He was first towed upwind so as to start 300 km. from the East Coast, and went so fast at first that his E.T.A. at Yarmouth was 3½ hours after take-off. But, in trying to maintain schedule, he dropped low at Silverstone and took a long time to recover height, so his total time for the 190 miles was 5½ hours.

The Bristol Club owns a Tiger Moth, and Tony Gaze, who comes over from his home at Ross by Auster, lends it to the club on busy days. The club sail-plane fleet is a T-21, T-31, Prefect, Olympia and Skylark 2, and a Swallow should have arrived by now, to help to replace the club's discarded Tutors. Privately owned machines are Peter Scott's Olympia 419, Tony Gaze's Ka-6, Doug Jones's home-built Skylark 3f, Col. Tapp's Kite 2, and an Eagle and two Skylark 2s owned by syndicates.

Weekly courses for non-members are run throughout the summer by Peter Collier, C.F.I., taking eight pupils at a time. As with many other clubs, more people apply for the courses than can be accommodated. One difficulty in satisfying this country-wide demand is to find qualified instructors and winch-drivers who are in a position to take temporary jobs during the summer.

At the Bristol Club I met Robert J. Parsons, who founded the Worthing Gliding Club in 1931 in conjunction with Norman T. Whiteman, whom he has lost touch with for a quarter of a century. They practically "were" the club, and built a primary B.A.C.2 of Lowe-Wylde design themselves.

* * *

THOSE who have been in gliding a long time may think they know every trick which the public are capable of on a gliding field. But they are mistaken, for the Midland Gliding Club has suffered a new one. The T-42, with instructor and pupil, was being bungied off from the Long Mynd. The wing-tip holder had let go, but the other wing refused to come up. The instructor looked round and saw two women hanging on to it. Eventually one of them let go, but the other hung on till she was a foot off the ground. By this time the glider had begun to roll and turn, but the instructor was just able to level up in time.

It turned out that the women were members of the public who were only trying to be helpful; they thought the glider was being blown away by the wind as soon as the wind began to rise, and imagined themselves lucky to be near enough to seize hold of it and (as they thought) prevent disaster.

* * *

EMINENT scientists have been notoriously unable to conceive how soaring flight is done, especially during the 19th century, when Lord Rayleigh was almost the only exception. Charles Darwin's observations of birds around South America have often been quoted, but John Randall, writing to the American journal *Soaring*, has found an attempted explanation which is new to me.

In Darwin's "Voyage of the Beagle," p. 196 of the 1890 edition, he describes seeing the condors move the head and neck frequently, "apparently with force." It did not seem to occur to Darwin that the condors did this in order to look at something. Birds must have less efficient otolith organs than mammals, for they have to keep their heads still in order to see an object clearly; this is probably why their head movements are short and quick. But Darwin's explanation is:—

"In the case of any bird soaring, its motion must be sufficiently rapid, so that the action of the inclined surface of its body to the atmosphere may counterbalance its gravity. The force to keep up the momentum of a body moving in a horizontal plane in the air (in which there is so little friction) cannot be great, and this force is all that is wanted. The movement of the neck and body of the condor, we must suppose, is sufficient for this."

* * *

A WORLD record of 9 hr. 4 min. for a radio-controlled model glider was set up in New Zealand last October, and after wondering since then whether it was done in thermals, waves or slope lift, I have at last been able to contact the owner, Mr. I. B. Barber. He himself had to wait even longer—three years—for the arrival of the right sort of weather to coincide with the presence of official timers and witnesses.

The place was 35 miles north of Wellington in North Island, on a steep 450-ft. slope facing west, 2½ miles inland from the sea, with flat land in between. As Mr. Barber hoped to put up 12 hours, it had to be done in the summer half of the year, when the most consistent west winds blow in October and November; so in a few weeks' time he will be trying to beat his own record again, now that it has been recognized by the F.A.I.

Human duration records for gliding are often disparaged as "mere" tests of endurance, whereas in fact most of them have included awkward moments which demanded a high degree of skill. The same applied to this model record, which was done in slope lift, with the air far too stable to produce thermals, since its temperature was the same (60° F.) from 1,200 to 1,800 ft. all day. The model needed a 10 m.p.h. wind to keep up, but the actual wind varied between 8 and 23 m.p.h., and its direction changed too.

The flight, Mr. Barber says, started at 06.30 in light rain. The sky was completely overcast all day with main cloud base at 1,000 ft. and odd wisps of cloud at 600 ft. The model flew mostly at 100 to 600 ft. above the hill crest, but it once got below the top due to inattention of the owner while filming it.

When the model entered small clouds, it was liable to drift back in them, due to a tendency to turn right; so it sometimes had to be dived to get back over the slope. But at 15.30, when it again did so, it had not enough height to pull out of the dive, so that was the end.

The model had a span of 7 ft. 1 in., weight 49 oz., and wing loading 8.4 oz. per 100 sq. in. Made of balsa and tissue, it had a "mid" wing, and a tailplane on top of the rudder fin. Rudder and elevator controls were worked by two rubber-powered servo motors operated through a two-valve receiver. This control equipment weighed 1.2 lb. and could have kept going for 35 hours. Flying speed could be varied between 22 and over 40 m.p.h.

Another use for radio-controlled gliders has been found in California, where a firm called Accurate Electronics is producing them at 20 dollars apiece for "bombing" forest fires with fire-quenching chemicals. Dropped from a converted B-26 bomber at 5,000 ft., one of them landed exactly on the planned spot after "two lazy circles." But forest fires create strong thermals and have even been known to trigger the growth of cumulo-nimbus clouds, so a glider performing "lazy circles" over a forest fire might well go up instead of down. But at least, if it got set on fire by lightning, it would put itself out.

* * *

BESIDES being holder of the World's model glider duration record, Mr. I. B. Barber flies with the Wairarapa Gliding Club in New Zealand, and is part owner of a Spatz 55. As a result of moving nearer to Wellington, from Masterton to Paraparaumu, the club has nearly doubled its membership. It owns a Rhönlerche, Rhönadler (Ka-7), Slingsby Swallow, and the Weihe formerly owned by Philip Wills in which he soared to 30,400 ft. over the Southern Alps. This Weihe is "worshipped by all members who have flown it." There is also a private Skylark 3f. Ted Ashwell, formerly of the Surrey Gliding Club, is chief instructor.

Paraparaumu enjoys good soaring in slope lift, thermals and waves, and has only had two non-flying week-ends in 10 months. The range of hills faces the prevailing westerly winds and stretches almost unbroken for 80 miles.

* * *

HOLDER of gliding certificate No. 14, and one of the earliest members of the London Gliding Club in 1930, L. C. Williams is now helping to start a gliding section of the Royal Aero Club of New South Wales. They plan to start with a high-performance two-seater, "as all members will be licensed private pilots," but Williams favours single-seaters as well. These, one may guess, would be needed in any case if the licensed private pilots are allowed to fly the two-seater without previous instruction. The "experienced aeroplane pilot" who thinks flying a glider is child's play has been the bane of some gliding sections of aero clubs in the past—and of other gliding clubs too.

Hitherto, most of the best soaring in New South Wales has been done by a private group, with almost one sailplane per member.

L. C. Williams left Fairey's in 1957 and is running a helicopter company operating in Australia and the Antarctic. He obtained his "C" gliding certificate on Feb. 15, 1931.

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A19

VANDERVELL
BUSHES

Vickers Vanguard
(above) Vandervell Bushes are fitted to flap mechanisms.

English Electric P.1. Supersonic Aircraft
(right) Vandervell Bushes are installed in actuating mechanisms for power assisted controls operating ailerons and tail plane.

Armstrong Whitworth Argosy Type AW 650 Freight-Liner
(below) Vandervell Bushes are fitted to pivot points on control mechanisms.

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Performance:

Side mounted hoses:

Rated condition 400 Imp. galls./min.—200 galls. each line. Suitable for fuelling Comets, Caravelles, etc.

Upper deck hoses:

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2. UNDERWING FUELLING FROM BRIDGER TANKERS OR OTHER SOURCES

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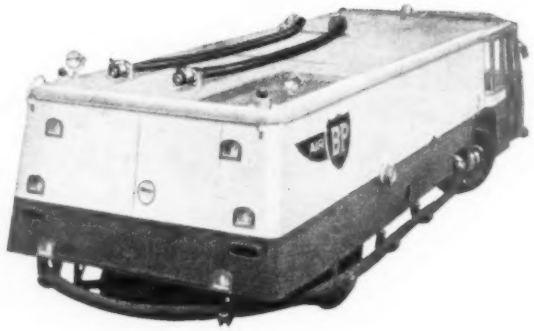

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Smee's V152

Correspondence

Pioneering in Space

THE similarity between the orbit of the Russian 1961 Venus probe and von Pirquet's 1928 orbit for the same mission as noted by K.W.G. in your Aug. 10 issue, p. 157, is indeed remarkable. I should like to join with K.W.G. and doubtless many others in congratulating von Pirquet on his foresight in this matter. It is always nice to know that one was right, even if the proof and acknowledgment are long delayed—in this case, 33 years.

Too often, acknowledgment of the truth of a scientific prediction is all that pioneers of von Pirquet's calibre get as reward for long years of unselfish devotion to subjects that are in advance of their time. In this instance it is a pity that the Russians have not acknowledged the similarity—and through this letter I should like to hint that it is still not too late for the Soviet Union to do so . . . officially.

For my part, I am inclined to think that the orbit for the Russian Venus probe was arrived at independently, and was used simply because it was right. Coincidences of this kind are bound to happen.

I must remark, however, that my belief in the integrity of Russian astronautical news has been rudely shaken by their documentary, "With Gagarin to the Stars." Accepting the opinion of well-informed and impartial critics, such as Gatland, I deplore the palming off of a T-1 tactical missile as the vehicle used. Indeed I submit, categorically, that this falsification of an historical event of the first magnitude is an affront not only to the astronautical fraternity but the whole human race.

Moreover, it is a falsification which the Russians themselves must admit at some later date . . . maybe in the near future, if one believes the promise that Press correspondents from the West will soon be permitted to see launchings.

Beaconsfield. H. E. Ross.

Unrecognized Russian Designers

I READ with great interest the short article on page 30 of the Jly. 13, 1961, issue of THE AEROPLANE AND ASTRONAUTICS by F.J.F. in regard to the recent recognition of several Soviet designers. You remarked on the absence of the name of S. A. Lavochkin and indicate that he is believed to be working on rockets. Actually, Lavochkin died on Jne. 9, 1960, which explains the absence of his name from the issue of *Krasnaya Zvezda* that you cite.

I am more surprised that the names of V. P. Glushko and L. S. Dushkin, both liquid-rocket engine designers, were not mentioned, but of course it seems to be a fixed policy to keep the names of their designers in the rocket field quite hidden.

Detroit, Michigan. Donald J. Ritchie,
Supervisory Mathematician.
The Bendix Corporation, Research Laboratories Division.

[F.J.F. wrote later to us to correct the impression given, in the article of Jly. 13, that Lavochkin might still be alive. "But," he writes, "I believe that, had Lavochkin been working on aircraft (as opposed to rockets) up to the time of his death, his name would have been in the list."—Ed.]

Give the VOR a chance!

AFTER reading OPtional Reading—5 (THE AEROPLANE AND ASTRONAUTICS, Aug. 3, 1961, p. 127) the old Shakespearean expression "Methinks thou dost protest too much" comes to mind. As a practising airline captain, I would like to say that my "worry circuit" is dormant, for instance, when operating into UAR 4, from approximately 150 miles west of the Irish Coast landfall at Kilkee, over Shannon VOR, Strumble VOR (even with its idiosyncrasies), Bristol VOR up to the time it is necessary to crank in and carefully identify Woodley/Watford. The latter two stations incidentally are two of the more reliable NDBs involved in that hotbed of "EUMED" NDB facilities.

My "worry circuit" really triggers off when approaching Prestwick via Skipness. Here we have the old-fashioned NDBs, difficult to tune and identify; with VORs installed "on test" for months now, right beside them. Prestwick-London via UAR 2 is guaranteed to change the "worry circuit" to a "panic circuit" at times. The generous sprinkling of NDBs at New Galloway, Dean Cross, Oldham, Lichfield, Daventry and again Watford all have varying good old-fashioned qualities guaranteed to lead the unwary astray.

If your Ministry would just put Prestwick and Daventry VORs on the commission list and move London VOR from its present useless position on London Airport and commission it at Watford NDB location, I will wager that 85% of the pilots operating into the London area over UAR 2 would heave such a sigh of relief that it would be heard above the noise-abated roar of LAP. This, in spite of all your stated plus and minus accuracies of VOR, air and ground based; and the further statement that "the system stinks."

So let's have some well placed VORs which, in conjunction with such facilities as Killard and Hack Green plus the World's finest radar at London Airport (I mean the people) would alleviate the flight deck scramble that takes place attempting to identify and hold track on old-fashioned NDBs in 550 m.p.h. jets.

Montreal, Quebec, Canada. G. K. Edward.

B.E.A.'s "Last" Pionairs

REFERRING to your news paragraphs, in the Jly. 27 and Aug. 17 issues, on the Pionair, I would like to point out that B.E.A. still operate Pioneer/Leopards, which differ only slightly from the true Pionair, being originally freighters, but now equipped as passenger aircraft.

Recently I flew from Aberdeen to Orkney in one of these, and on this route at least they will remain in service until replaced by a newer aircraft.

R.A.F. Yatesbury, Wilts. R. H. Campbell.

[B.E.A. still has seven Pioneer/Leopards—convertible passenger-freighters—which are used on the Scottish routes and on some freight services. They will become redundant next year when the all-freight Argosies go into service and the H.P. Heralds are operating over the Scottish routes. B.E.A. also owns four Pionairs which are on lease to Cambrian Airways.—Ed.].

Roundabout

Displaytime

"I'm not taking any chances with your Farnborough weather this year—I've mixed anti-freeze with my sun-tan lotion."

*

The publicity people of the S.B.A.C. and Air Ministry must have been pretty glum just before Farnborough. They sent out early and copious information about the 40-strong V-bomber fly-past, then a rehearsal which took the bombers over London had that city's citizens ringing up by the hundred to inquire anxiously if war had broken out.

*

"The general opinion among the organization's lower echelons is that what we've lost in paying passengers has been made up by the number of passengers within the management."

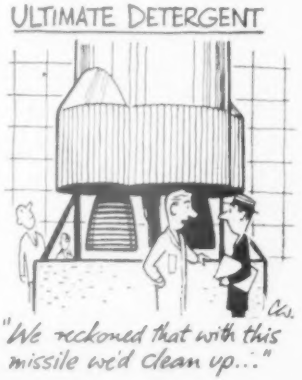
*

"I hear that Parfitt fell into one of our adding machines and found that he didn't amount to much."

*

If you saw any Pakistan Air Force officers looking a bit smug, it was probably because they'd read that Rolls-Royce technical circular announcing that the P.A.F. were counting on getting a "1,200-yr. engine life" out of the Darts in their Viscount.

*



by Lorenz

Industry Record

Rocket Launcher Adoption

Following the lead of the R.A.F., the R.N.Z.A.F. has ordered Microcell glass-fibre rocket launchers for its Canberra B(I)12s. Like the Canberra B.15 and B.16 these are to be fitted with underwing pylon-mounted packs each containing 37 x 2-in. air-to-ground rockets. Microcell has four types of launcher currently in production for the R.A.F.'s Lightnings, Hunters and Canberras and the Sea Vixens and Scimitars of the Navy.

Generating Vibration

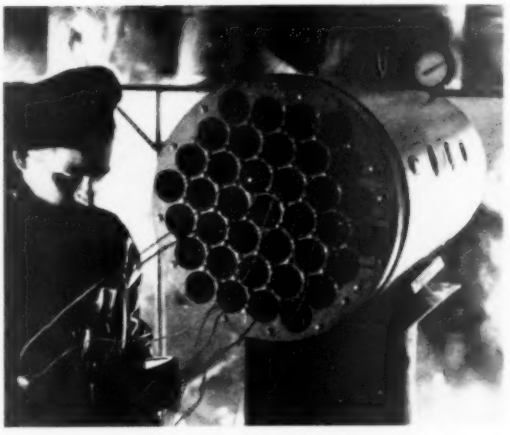
From the research and engineering division of Fairey Air Surveys has come news of a very low frequency vibration generator. This has a 2,000-lb. thrust with a working range of 0 to 50 c.p.s., and a 4-in. maximum stroke at the lowest frequencies. Both frequency and amplitude are remotely controlled from a power console and may be varied while the equipment is running.

The vibrator unit uses a hydraulic jack actuated by an electrically signalled valve and is connected to the control-unit power-pack by two high-pressure hydraulic lines and one electric control cable. The equipment is supplied complete, and no further amplifiers, oscillators or output transformers are necessary.

The vibrator itself weighs 1,100 lb., and the control unit/power pack 600 lb. The power requirement is 4½ kW. at 440V. 3-phase + neutral 50 cycles AC supply.

Basically, the equipment's ability to maintain a dynamic thrust of 2,000 lb. over the full frequency range of 0-50 c.p.s. means that it is capable of vibrating an item of this weight fixed to the table top and that it can also exert this load to an existing structure (such as a high-set tailplane) through appropriate linkage rods. Another of the equipment's features is that it is capable of exerting a static thrust of up to 10,000 lb. when a non-vibratory load has to be exerted on a structure. This can be used in fatigue testing to impose a pre-load on the structure using the positioning facility of the jack; vibrations may then be superimposed on this pre-loading about the deflected position.

Typical applications of this new vibration generator are the determination of very low frequency resonances on aircraft structures, such as wings and tailplanes, and on motor vehicle suspension systems and chassis.



Testing electrical resistances of a Microcell glass fibre rocket launcher under simulated tropical conditions. Discussions between the company and NATO representatives concerning the adoption of the launcher, begun at the Paris Show, were resumed during last week at Farnborough.

New Components from Redhill

Tiltman Langley, Ltd., the Redhill company which for many years has been concerned with the design and manufacture of aircraft components as well as pure research and test work, is to consolidate its activities by the introduction of a production line. From this will come initially a range of aircraft components associated with temperature and control.

Among the items which comprise this range are hermetically sealed thermal switches charged with inert gas for operation in high ambient temperatures; non-return valves, in light alloy or stainless steel, incorporating a balanced flap arrangement in order to damp movement; butterfly-type control valves for air or gas flow over a wide temperature range; and pneumatic actuators of both the two-position and modulating type. Also to be produced are a temperature-control system; heated waste-water outlets; and the Tiltman Langley slip-lock—a quick-release positive-lock coupling.

Computor for Bristol

A third British aircraft constructor has ordered a PACE analogue computer system from Electronic Associates. Bristol Aircraft, Ltd., are to install a 231R at Filton to deal primarily with missile development problems.

Argosy Comfort

Passenger seats for the 56 Argosy C.1s on order for R.A.F. Transport Command are to be built by Short Brothers and Harland, under an Air Ministry contract. This is for 1,325 of the Short 260 series, to be supplied in double and triple sets. Each set is hinged so that it can be moved to stand against the fuselage wall, leaving the floor area available for freight or stretcher cases.

The type 260 seat is a development of that installed in R.A.F. Britannias and is the product of close collaboration between Shorts and the Institute of Aviation Medicine. It is regarded, says the company, as one of the safest available anywhere in the World. The seat back is normally positioned at 12° to the vertical, but can be adjusted through a further 32° in eight stages to suit personal requirements.

Some 7,500 seats from the Short General Engineering division at Newtownards are now in military and commercial use.

Short 260 series passenger seats installed in an A. W. Argosy C. Mk. 1 of R.A.F. Transport Command.

Aviation Calendar

Sept. 14

London.—Science Museum lecture. "Astronomy including the Star Dome," at the Science Museum, Exhibition Road, S.W.7, at 15.15 hrs.

Sept. 16

R.A.F. at Home.—Battle of Britain Day; 16 R.A.F. stations open to the public.

London.—Science Museum lecture. "The Story of Flight," at the Science Museum, Exhibition Road, S.W.7, at 15.15 hrs.

Sept. 17

London.—Battle of Britain Service of Thanksgiving, at Westminster Abbey.

Sept. 22

Oxford.—Institute of Transport Weekend Conference, until Sept. 25.

Sept. 23

Munich. Munich Flying Group Second Oktoberfest Rally, until Sept. 24.

Sept. 26

London.—Institute of Navigation and Electronic Engineering Association combined lecture. "The Transit Navigation Satellite System," by Dr. R. Kershner and Dr. R. Newton, at the R.G.S., Kensington Gore, S.W.7, at 10.00 hrs.

Sept. 28

London.—Science Museum lecture. "Astronomy including the Star Dome," at the Science Museum, Exhibition Road, S.W.7, at 15.15 hrs.

Company Notices

NEW COMPANIES

Air-Bush Operators, Ltd. (701,649).—Private co. Reg. Aug. 25. Cap. £1,000 in £1 shrs. To construct, let on hire and deal in aeroplanes, flying machines. Sec.: Stanley H. Lucas. Reg. off.: 6-9 Surrey Street, W.C.2.

Farmair Services, Ltd. (701,460).—Private co. Reg. Aug. 23. Cap. £100 in £1 shrs. To carry on the business of aeroplane engineers, agricultural implement repairers, to let on hire aeroplanes or aircraft for crop spraying. Directors: Brian Collins, 7 Hudson Street, Deddington, Oxon. John Riseley-Prichard, Fringford Mill, Nr. Bicester, Oxon. Sec.: B. Collin.

Flying Transport, Ltd. (701,367).—Private co. Reg. Aug. 22. Cap. £100 in £1 shrs. To carry on the business of air transport contractors. Sec.: Stanley H. Lucas. Reg. off.: 6 Surrey Street, W.C.2.

New Patents

APPLICATIONS ACCEPTED

879,843.—**ACF Industries, Inc.**—"Turbo compressor tachometer simulator for grounded aircraft trainers." Dec. 24, 1959.

879,332.—**Licentia Patent-Verwaltungs G.m.b.H.**—"Stabilizing fin for aircraft and ships." Dec. 29, 1959. (Jan. 29, 1959.) (Addition to 825,134.)

879,974.—**Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.**—"Control device for aircraft." Nov. 28, 1957. (Dec. 4, 1956.)

879,862.—**United Aircraft Corporation.**—"Airfoil temperature control means." Feb. 6, 1958. April 23, 1957.)

879,966.—**J. Martin.**—"Aircraft escape apparatus." Jan. 4, 1960. (Jan. 2, 1959.)

879,969.—**Rolls-Royce, Ltd.**—"By-pass and ducted fan gas turbine engines." Jan. 4, 1960. (Jan. 28, 1959.)

Printed specifications of the above will be available on Oct. 11, 1961, and the opposition period will expire on Jan. 11, 1962.

DO 28 Design for safety

Dornier DO 27 and DO 28 STOL aircraft proven the world over

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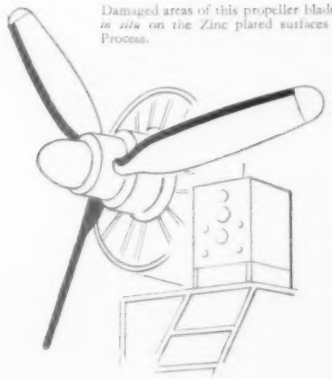
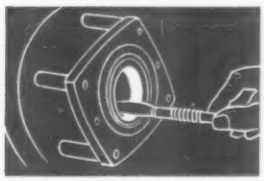


Damaged areas of this propeller blade repaired *in situ* on the Zinc plated surfaces by Dalic Process.



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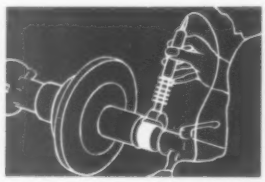

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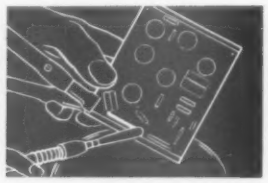

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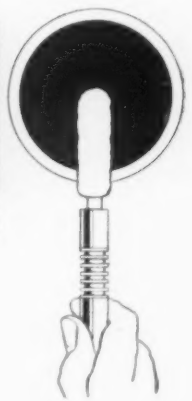

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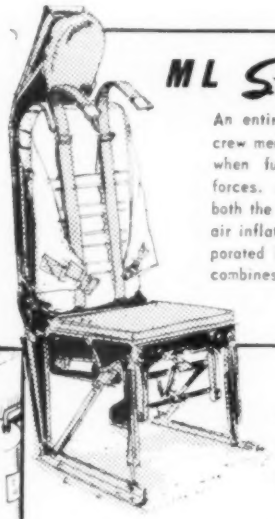

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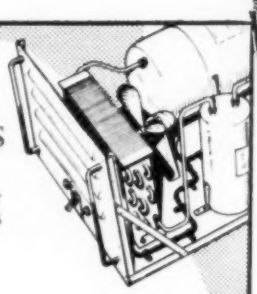

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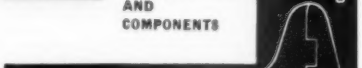

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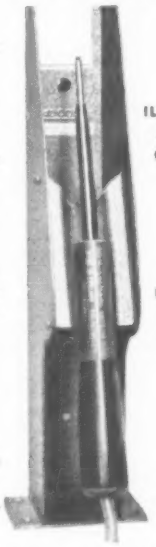

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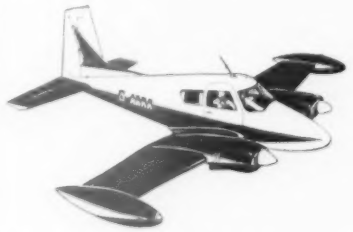

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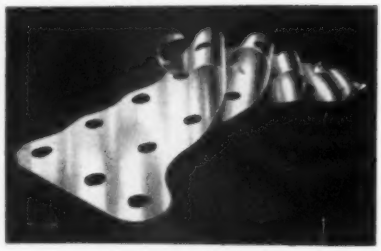

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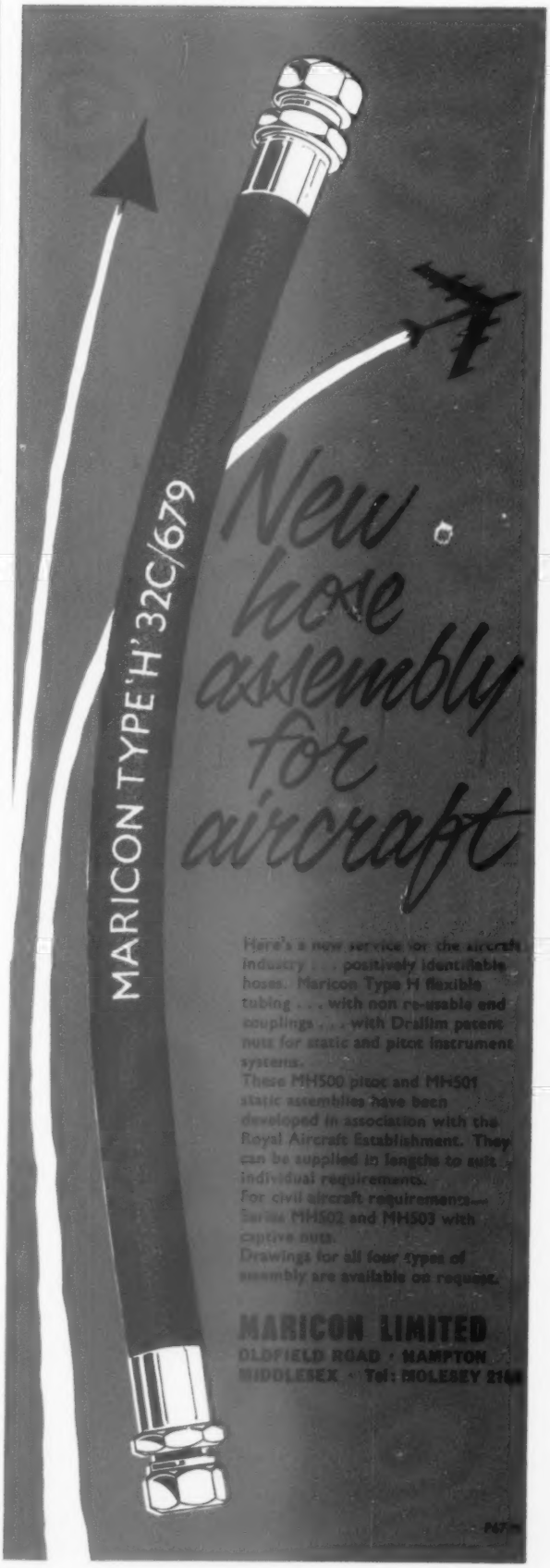
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